# Speaker Biographies and Abstracts

## *PLENARY & GUEST SPEAKERS*

**WELCOME:** ***Jon W. Allan,*** *Director, Michigan Office of the Great Lakes*

Jon Allan comes to the Office of the Great Lakes with a strong background in fisheries and wildlife and in the aquatic sciences. With nearly three decades of experience in environmental and energy policy, he has taught courses in biology, ecology, environmental impact assessment, and marine biology and island ecology at Michigan State University and other institutions. His research on wetlands, stream ecology, impact assessment and water policy has been published in journals in Canada and the U.S. Time and again, organizations and individuals have called on Director Allan to participate in and lead environmental planning in Michigan and the Great Lakes region. Prior to joining the State of Michigan, he served in a number of executive management positions in the private sector.

He has served as advisor to the Great Lakes Compact negotiations, co-chaired Michigan's Groundwater Conservation Advisory Council and the Water Resources Advisory Council that was tasked with formulating the state's implementation of the Great Lakes Compact, was appointed to the Michigan Climate Action Council and to the Midwest Governors' Greenhouse Gas Reduction Accord Advisory Group, served on the Environmental Advisory Council for the Michigan Department of Environmental Quality and as co-chair of the Governor's Blue Ribbon Panel on State Parks and Recreation. He also chaired the Michigan Chamber of Commerce's Environmental Quality Committee and the Global Climate Change Committee at Edison Electric Institute.

He currently serves as Chair of the Great Lakes Commission and is an advisor to numerous other regional organizations including the Great Ships Initiative, the Great Lakes Integrated Science and Assessment Center, the Great Lakes Executive Committee, Michigan Sea Grant, and is on the Executive Committee for the Council of Great Lakes Governors and the Conference of Great Lakes and St. Lawrence Governors and Premiers.

**KEYNOTE:** ***John Wathen,*** *U.S. Environmental Protection Agency, Office of Water*

John Wathen is now senior scientist for fish and beach programs in the Standards and Health Protection Division of the Office of Science and Technology in the U.S. Environmental Protection Agency's (U.S. EPA's) Office of Water. He served as assistant or acting chief of the Fish, Shellfish, Beaches and Outreach Branch (FSBOB) since coming to the U.S. EPA, until it was combined recently with the National Standards Branch. Mr. Wathen received his B.A. in Geology from Northeastern University and an M.S. in Earth Sciences from the University of New Hampshire. He worked as a consulting hydrogeologist for 15 years, primarily in northern New England, and served as Southern Maine Regional Director of the Maine Department of Environmental Protection 2000-2005 before joining the U.S. EPA. He provides technical support to the BEACH Act monitoring and advisory program, National Fish Advisory Program, and OW's fish tissue contaminant studies, focusing on human health implications. Mr. Wathen is a Maine Certified Geologist, a Registered Geologist in Kentucky, and a Certified Ground Water Professional.

**SPECIAL GUEST SPEAKERS: *Mary Catterlin and Amy Lukas***

Amy Lukas graduated from Valparaiso University in 2011 with a BS in Biology, minors in Chemistry and Humanities. Mary Catterlin graduated from Indiana University in 2011 with a BA in Fine Art.

When Mary started hand carving a cottonwood tree into a dugout canoe, Amy knew they were in for an adventure. Spurred by their love of Lake Michigan and a desire for a challenge, they dreamed big.

Both Amy and Mary were relatively (okay, completely) new to long distance expeditions when they set off on their 1200 mile journey around Lake Michigan aboard their handmade dugout sailing canoe in the summer of 2012. Amy and Mary are both relatively (okay, completely) new to the realm of book & film, but they thoroughly enjoyed the process of telling a story they love. Their 93 day adventure has recently taken the form of a published illustrated journal and a full length documentary detailing the ins and outs of their dream coming to life. They hope to inspire others to follow their dreams, no matter how ridiculous.

**Lake Michigan in a Dugout: The Documentary:** This is a film following the story of two women chasing their ridiculous dream: to journey around Lake Michigan aboard their handmade dugout sailing canoe, an adventure that would ultimately take them over 1200 miles in 93 days. Told in part through the friendly banter between the two and the friends they made along the way, the documentary explores the search for everyday adventure and the power of our imaginations to push dreams into reality.

## SPECIAL TRIBUTE

***JUDY BECK***

The Lake Michigan Forum, Lake Michigan Watershed Academy, Lake Michigan Monitoring Coordination Council, affiliated Lake Michigan basin agencies and partner organizations, the Great Lakes Beach Association, and others recognize Judy Beck for nearly two decades of dedicated and effective leadership in coordinating Lake Michigan management and restoration. Judy Beck was the Lake Michigan Manager in the Great Lakes National Program Office, USEPA from 1995-2014. She chaired the multi-agency Lake Michigan Lakewide Action and Management Plan (LAMP) process called for in the Great Lakes Water Quality Agreement. She skillfully guided the work of the Lake Michigan Forum and was instrumental in the formation of the Lake Michigan Monitoring Coordination Council and the Lake Michigan Watershed Academy. She provided inspiration for the first and each succeeding State of Lake Michigan Conference and organized the first major Great Lakes beach conference which led to formation of the Beach Association. Judy also volunteers her time to the League of Women Voters and their Lake Michigan organization, serving on their Board before and after her position at USEPA. Judy also served as an elected Commissioner of the Glenview Park District for 32 years and as a president of the Illinois Association of Park Districts. She now has a park named in her honor. We heartily thank Judy for all she has done to bring diverse groups together and facilitate multi-agency and stakeholder engagement in restoring and sustaining the health of Lake Michigan.

# *SESSION SPEAKERS*

**ABOOD, SINAN,** *Spatial Analyst-Research Fellow, USDA Forest Service*

Sinan A. Abood holds a PhD in Environmental Engineering-GIS & Remote Sensing Applications, 2011 at the School of Forest Resources & Environmental Science-Michigan Technological University. His first postdoctoral assignment was with the Institute of Terrestrial Ecosystems at the Swiss Federal Institute of Technology ETH Zurich, Switzerland (2011-2013) as a Research Fellow working on estimating the role of land extracting industries (oil palm plantation, acacia/pulp, and logging) on natural habitats loss and measuring the impacts of land cover change on tropical biodiversity in Southeast Asia. Currently, Mr. Abood is performing his second postdoctoral assignment as a Spatial Analyst-Research Fellow with the Watershed, Fish, Wildlife, Air, and Rare Plants (WFWARP) program, Washington Office USDA Forest Service. His research focuses on two main objectives: developing riparian areas inventory/monitoring system for National Forest and Rangelands utilizing the Riparian mapping tool (RBDM), and incorporating the use of Unmanned Aerial Systems (UAS) applications in forest monitoring, wildlife applications, illegal logging, surveying and ecosystem monitoring and managements.

***Riparian Inventory: A GIS Approach***

Riparian areas are complex, dynamic and diverse zones along aquatic ecosystems. The location of riparian areas between upland and aquatic systems is becoming increasingly important for watershed management and serving as ecological reserves and biological corridors. Delineating riparian areas is a challenge for resource managers and decision-makers due to variation in the definition of a riparian area. There are widely varying interpretations across federal and state agencies and between academic disciplines. Previous approaches to riparian area delineation have utilized fixed width buffers, but this methodology has proven to be inadequate. Here we present a cost effective robust model to consistently map the geographic extent and composition of riparian areas utilizing the geospatial capabilities of ArcGIS 10.2 and open source data. This approach recognizes the dynamic and transitional natures of riparian areas by accounting for hydrologic, geomorphic and vegetation data as inputs into the delineation process, and the results would suggest incorporating functional variable width riparian mapping within watershed management planning to improve protection and restoration of valuable riparian functionality and biodiversity.

**ADAMS, MARY STEWART,** *Program Director, Headlands International Dark Sky Park*

Mary Stewart Adams led the initiative that resulted in Emmet County's Headlands property achieving designation as one of the world's few internationally-protected dark sky parks in 2011. She has received numerous awards for her work, and speaks to audiences locally, nationally, and internationally about the role of stewarding natural darkness to enhance cultural consciousness and for the protection of natural habitat.

***Great Lakes, Dark Skies: Effects of Artificial Light in Coastal Areas***

Let's talk about how light creates the mood of our environments and that, whether it's natural or artificial, the role of light in our shoreline communities is critical for recreation, habitat, and aesthetics. New lighting technology such as LED can answer the energy and convenience concerns, but there is much to be done with regard to the level of 'light pollution' caused by such lights, and the ways they are used. So what's available? What's recommended by the International Dark Skies and Astronomy researchers? How can artificial light at night in our shoreline communities enhance visibility while also protecting habitat and providing non-invasive safety? In this session, we'll consider current avenues for creating lighting management plans, while providing information about the best light at night for specific environments, based on research from the 2015 Artificial Light at Night Conference held recently in Quebec, Canada.

**ARBOGAST, ALAN, Dr.**, *Department of Geography, Michigan State University*
Alan is a Professor and Chairperson in the Department of Geography at Michigan State University. He is a geomorphologist who focuses primarily on the evolution of coastal sand dunes along Lake Michigan. Along with his collaborators, his research has shown that these landforms have a complex history of growth and stability that spans the past ~5,500 years. He has authored or co-authored numerous peer-review publications on this topic and his work has been discussed in a variety of media outlets. Alan recently served on the Advisory Committee of a project to reassess and advance the science associated with coastal dune management in Michigan. This project was co-sponsored by the Michigan Department of Environmental Quality, the Michigan Environmental Council, the Office of the Great Lakes, and the National Oceanic and Atmospheric Administration.

**Hemispheric ENSO Cycling and Lake Michigan Coastal Dune Evolution: A Relationship?**
*Co-authors: Dr. G. William Monaghan, Indiana Geological Survey; Dr. William A. Lovis, Department of Anthropology, Michigan State University*
The chronology of coastal dune evolution along Lake Michigan has been the focus of intensive research for the past 20 years. Although early studies associated episodes of dune growth to high lake stages, this relationship remains unclear, as do the potential roles of storminess and hemispheric atmospheric circulatory processes. We refined the record and association with potential forcing variables through a statistical synthesis of the > 250 14C and optical dates reported thus far. A probability density distribution (PDD) demonstrates that seven major cycles of dune growth occurred in the past 5,500 years. Five periods of dune growth transpired during lake transgressions, whereas two occurred during lake regressions. Intervals of dune growth may also be related to hemispheric atmospheric circulatory patterns associated with the reconstructed history of ENSO (El Niño/La Niña) cycling in the Galapagos Islands. Episodic growth of dunes between about 4,500 and 2,000 years ago correlates well with the highly variable frequency and amplitude of El Niño and La Niña events, respectively. Extended coastal dune stability between 2,000 and 1,000 years ago is closely associated with a significant decrease in ENSO activity. These associations suggest a linkage between lake-level fluctuations and sand supply and storminess. Our model is supported by 1) the dominant temporal correlation of dune activation with transgressive lake phases associated with higher basin input and 2) the dominant southwest orientation of over 1,200 parabolic dunes, suggesting their primary mobilization in the late autumn and early winter when the strongest modern winds occur in association with deep cyclones lifting out of the south-central Great Plains. These findings suggest that dominant intervals of coastal dune building in the Great Lakes region are not related to any single factor, but rather the cyclic convergence of several forcing variables, some of which are hemispheric in nature.

**BEACH, MICHAEL J., PhD**, *Associate Director for Health Water, Center for Disease Control and Prevention*
Michael J. Beach, PhD is Associate Director for Healthy Water in the Center for Disease Control and Prevention's (CDC's) National Center for Emerging and Zoonotic Infectious Diseases and Chief of the Waterborne Disease Prevention Branch. He oversees the Center's waterborne disease prevention activities including waterborne disease outbreak investigations and national surveillance for waterborne disease outbreaks, giardiasis, cryptosporidiosis, and free-living amebae. He created CDC's Healthy Swimming Program and was the CDC representative on the U.S. Environmental Protection Agency National Epidemiological and Environmental Assessment of Recreational (NEEAR) Water beach water quality study. He has been involved with U.S. Environmental Protection Agency's Great Lakes Restoration Initiative for several years and is a member of the International Joint Commission's Health Professionals Advisory Board (HPAB).

**Emerging and Climate-Sensitive Pathogens in Ambient Water Settings**
*Co-authors: Jonathan Yoder, CDC ; Jennifer Cope, CDC; Virginia Roberts, CDC; Michele Hlavsa, CDC*
The U.S. Centers for Disease Control and Prevention (CDC) partners with state public health departments to monitor the occurrence and geographic distribution of individual cases and outbreaks of disease associated with fresh water exposures, including illnesses caused by pathogens that might be affected by temperature increases or other factors related to climate change. Recent data suggest that there is an increasing northward geographic distribution of primary amebic meningoencephalitis caused by Naegleria fowleri. Historically, cases were geographically limited to fresh water exposures in southern-tier states. Minnesota reported its first two cases in 2010 and 2012; Indiana reported its first in 2012. Health data

from CDC's Vibrio surveillance and environmental data sources confirm that pathogenic Vibrio species are now established on the west coast to Alaska and on the east coast to the Chesapeake Bay in Virginia. The increasing occurrence and severity of harmful algal blooms (HABs) in ambient water, including the Great Lakes, and the documented health impacts of such blooms are a public health concern for those who use lakes for recreation, drinking water, or industrially. Successful public health disease and outbreak tracking and prevention and control of disease caused by climate-sensitive waterborne pathogens will require additional expertise, resources, and partnerships with environmental health professionals (e.g., inspectors) and beach managers. CDC is collaborating with state and federal partners to support this work by expanding its online drinking water advisory communications toolkit to include HAB events, creating pathogen-specific educational content (e.g., HAB and Naegleria websites), and building overall waterborne disease and prevention capacity in the Great Lakes states.

**BECK, JUDY,** *Illinois Board Member, League of Women Voters Lake Michigan Region*
Judy Beck was the Lake Michigan Manager in the Great Lakes National Program Office, U.S. Environmental Protection Agency from 1995-2014. She was also involved in the League of Women Voters and their Lake Michigan Organization serving on the Board before and after her position at the U.S. Environmental Protection Agency. She combines 32 years of federal experience with 32 years of locally elected public office and non-governmental experience for a view on successful stakeholder involvement.

**A Sustainable Lake Michigan Requires a Sustainable Framework for Literate, Engaged Stakeholders**
Since 1987, when the Great Lakes Water Quality Agreement called for stakeholder involvement in the governance of the Great Lakes, many different approaches and funding scenarios have been tried in the attempt to meet the goal. The goal was not clearly defined nor how success would be measured. The funding and general description of success changed with management and/or funds available. Each of the five lake basins organically developed a framework suited to the unique basin needs. This approach has provided a history of experiences and lessons learned which can be built upon. If we combine that history with a suite of new tools and new needs, we can develop a new framework that works for now but is also sustainable. We need a framework that "fits" in its basin but also avoids duplication of effort and the wasted energy of reinvention. A stakeholder framework should have the flexibility to evolve over time and remain sustainable.

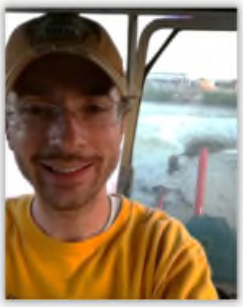
**BEYER, AMY,** *Director, Conservation Resource Alliance*
Amy Beyer is the Director for the Conservation Resource Alliance (CRA) in Traverse City, Michigan. The CRA is a private, non-profit organization that assists communities with the protection, restoration, and responsible development of northern Michigan's lands and waters. Ms. Beyer has Master and Bachelor of Science degrees in chemical and environmental engineering from Michigan Technological University. She was responsible for developing CRA's innovative River Care and Wild Link programs; both are regional initiatives for involving landowners, local business, corporate, government, municipal, and foundation partners in proactive, large-scale habitat conservation projects. Ms. Beyer worked in the environmental consulting field as a business manager and project engineer for eight years prior to joining the Conservation Resource Alliance in 1992.

**Boardman River Reborn - Community Lessons in Dam Removal, Overview**
*Co-authors and presenters: Troy Naperala, AECOM/URS - project technical lead; Marty Melchior, Regional Director,, Inter-Fluve; Becky Ewing, Rotary Charities of Traverse City; Kathy Huschke, Oleson Foundation*
The Boardman Dam removal project – the largest dam removal in Michigan's history - is delivering real, on the ground results, with removal of the first barrier completed in 2013, and the second planned for 2017. When completed, the project will result in removal of 3 dams, modification of a 4th to provide fish passage from the Great Lakes, creation of 4 new miles of high-quality stream, elimination of warming caused by impoundments, and restoration of fish passage and connectivity in 160 miles of Blue Ribbon cold water fishery for the first time in over 100 years. The unprecedented community partnership process provides a template for decision-making, design and financing for other dam removal projects nationwide. Lessons and insights are accruing rapidly on this first-of-its-kind project, one of the most widely recognized and publicized dam removal projects in the country. Presenters will share insights, tools and lessons learned in the following areas:

- A collaborative process worth emulating – advanced techniques and materials for building and maintaining an effective partnership over time to make projects better and get more out of every dollar invested.
- When something goes wrong – opportunities for excellence and building community support in the face of unexpected problems.
- Jobs and economic impacts – metrics and how to relate them to the public, illustrating the real significance of habitat restoration work on the ground.
- Innovation in natural system restoration design – putting wood back in rivers, depth of refusal to locate relic channels, and what happens when we re-start the sediment moving "machine" are all generating wide ranging interest and opinions.
- Prosperity planning – a new look at the concept of watershed planning beyond dam removal, comprehensively framing recreation, transportation, and economic development in conjunction with restoration and protection of precious water and land resources.

**View from the Field - Connecting Streams in Northern Michigan**

The Conservation Resources Alliance, in partnership with The Nature Conservancy and Huron Pines, intends to restore connectivity of 600 miles of streams in the upper Great Lakes and improve habitat in over 5000 miles of streams. Through Great Lakes Fish and Wildlife Restoration Act funding, CRA with its partners were able to address high priority river barriers with the best science, while leveraging resources from numerous sources, creating greater efficiencies and broader impact. This 34-project initiative led to reconnection of 245 miles of stream and significant reductions in sediment loading in three years. This type of regional initiative is very instructive to developing a shared vision for what a regional connectivity collaborative should and could provide. We will address how we were able to create this joint initiative, called River Care, what allowed for development of shared priorities, and lessons learned. We will also present our strategy and needs for the next phase of work, which includes finishing restoration in small and medium sized watersheds, developing new tools for assessment, prioritization and quantifying benefits, expanding regional efforts to take advantage of efficiencies from carrying out multiple projects on a large scale, and tracking progress towards restoration benchmarks. Finally, we will discuss the importance of addressing lowest barriers to accomplish the full reconnection of Great Lakes tributaries.



**BURCH, TUCKER R.,** *Research Hydrologist, U.S. Geological Survey, Wisconsin Water Science Center, Laboratory for Infectious Disease and the Environment*

Tucker Burch is a Research Hydrologist for the U.S. Geological Survey's (USGS') Wisconsin Water Science Center in the Laboratory for Infectious Disease and the Environment (LIDE), which is an interagency laboratory supported by the Wisconsin Water Science Center and the U.S. Department of Agriculture (USDA) – Agricultural Research Service. Tucker is responsible for developing the LIDE's quantitative microbial risk assessment program, which links the abundance and distribution of pathogens in the environment to human health risks. The two general goals of his work are to 1) estimate the risk of human exposure, infection, and illness to pathogens in air, water, and soil and 2) provide decision-support data to resource managers and policy-makers interested in mitigating the transmission of infectious disease through the environment. Tucker studied environmental science at the University of Wisconsin – Green Bay, received a B.S. in Civil Engineering from Marquette University, and completed a Ph.D. in Civil Engineering at the University of Minnesota.

**Quantitative Microbial Risk Assessment for Recreational Waters at Three Lake Michigan Beaches**

*Co-authors: Steven R. Corsi, Research Hydrologist, USGS, Wisconsin Water Science Center; Susan K. Spencer, Microbiologist, USDA; Rebecca B. Carvin, Physical Scientist, USGS, Wisconsin Water Science Center; Mark A. Borchardt, Research Microbiologist, USDA*

Quantitative microbial risk assessment (QMRA) was used to estimate distributions of infection and illness risks for individual swimming events during the 2010 swimming season at three Lake Michigan beaches in Wisconsin and to investigate factors that influence those risk estimates. The results demonstrate the utility of QMRA for understanding site-specific risks of gastrointestinal infection and illness in recreational waters at Great Lakes beaches and for guiding risk mitigation efforts.

**DONALD C. CARPENTER,** *Lawrence Technological University*
Donald D. Carpenter, PhD, PE, LEED AP and co-presenter, is a professor of Civil Engineering at Lawrence Technological University where he teaches courses on ethics, professionalism and water resources. Dr. Carpenter received his PhD from the University of Michigan in 2001 and is the principal investigator on the integrated assessment.

**Sustainable Small Harbor Management – Building a Strategy**
*Co-authors: Amy Samples, Catherine Riseng, and Mark Breederland, Michigan Sea Grant; Robert Pettit, Environmental Consulting & Technology (ECT) Inc.; Nathan Christie, ECT Inc.; Sanjiv K. Sinha, ECT, Inc.; Matt Bingham, Veritas Economic Consulting, LLC; and David Knight, David Larkin Knight, LLC*
The Sustainable Small Harbor Management Strategy Project is focused at an exploration of opportunities and best practices to build an overall strategy for financial, social, and environmental management and sustainability for Michigan's small harbors. The effort reflects a broad partnership of planners, regulatory agency staff, and local stakeholders engaged in developing planning resources for Michigan's harbor communities. The project is supported and guided by advisors at Michigan Department of Natural Resources - Waterways Commission, Michigan Sea Grant, Michigan Department of Environmental Quality - Office of the Great Lakes, and Michigan State Housing Development Authority. The project team first compiled and developed social, economic, environmental, infrastructure, and recreational information for four Michigan communities. Community visioning occurred in a series of three public meetings per community, including a three-day public charrette, where local stakeholders shared their visions and ideas for their waterfront in a structured set of planning exercises. Then, using this focused community visioning process, the team plans to explore a range of opportunities for revenue generation and cost savings and best management practices to support long-term sustainability. The eventual small harbor management strategy will be developed using the existing information, field observations, and input from a multi-disciplinary advisory board, waterfront stakeholders, and the research team. The research team also plans to develop a toolkit that can be used by coastal communities to help develop strategies for resilience and sustainability to economic, social, and environmental change. The toolkit will include an economic analysis tool that coastal communities can use to assess the financial viability of their harbors. The team will share the toolkit with two additional communities in early 2016 to gauge the transferability of the toolkit to other waterfront communities. Anticipated findings are expected to help inform both the development and content of management plans for harbor communities in building physical and economic resilience.

**CAVALIERI, VINCENT,** *Wildlife Biologist, U.S. Fish and Wildlife Service*
Vincent is a Wildlife Biologist for the U.S. Fish and Wildlife Service (USFWS) where he has been the Great Lakes Piping Plover Recovery Coordinator for five years. Vincent's primary interest is in the ecology and conservation of birds and has worked on many research projects with other rare bird species, including Cerulean Warbler, Mountain Plover, Kirtland's Warbler and Trumpeter Swan. He has a bachelor's degree in Fisheries and Wildlife from Michigan State University and a master's degree in Wildlife Ecology from Oklahoma State University. Prior to working for the USFWS, Vincent worked for the Oklahoma Cooperative Fish and Wildlife Research Unit on a project in the Lower Rio Grande Valley of Texas.

**Great Lakes Piping Plover - Status of the Population and Recovery Effort**
*Co-author: Christie Deloria, Great Lakes Coastal Program Coordinator, U.S. Fish and Wildlife Service*
The Great Lakes Piping Plover is one of the most critically endangered species in the region. When put on the Endangered Species List in 1986, there were fewer than 20 pairs of plovers left in the entire Great Lakes Basin and these were limited to a few scattered locations in northern Michigan on Lakes Michigan and Superior. After nearly three decades of recovery efforts, the species is slowly making a comeback with 70 pairs in the basin in 2014. Piping Plovers have returned to breed in Wisconsin and Ontario, Canada and to Lakes Huron and Ontario. This presentation will detail the status of the species today and the future direction of the Great Lakes Piping Plover Recovery Program.

**CLARK, GENE,** *Coastal Engineering Specialist, Wisconsin Sea Grant Institute*

Gene Clark, Coastal Engineering Specialist with Wisconsin Sea Grant Institute, is based at the Lake Superior National Estuarine Research Reserve in Superior, Wisconsin. As one of the few full-time Sea Grant Coastal Engineering specialists in the country, Gene provides coastal engineering expertise, as well as port, harbor and marina engineering assistance to Wisconsin's state and local government officials, contractors, and lakeshore property owners along Lake Michigan and throughout the state. Gene is involved in leading water safety efforts, in collaboration with Wisconsin's Coastal Management program. He holds a B.S. degree from Texas A&M University in Ocean Engineering, a M.S. degree from the University of Florida in Coastal Engineering and a second M.S. degree from the University of Wisconsin in Civil and Environmental Engineering.

**Be Current Smart: Targeting Parents and Teens to Improve Water Safety**

*Co-authors and presenters: Elizabeth LaPorte, University of Michigan, Graham Sustainability Institute; Brent Schleck, Minnesota Sea Grant*

Launched in May 2015, the Be Current Smart water safety campaign (CurrentSmart.org) is a collaboration of the National Oceanic and Atmospheric Administration's (NOAA) Sea Grant and Coastal Zone Management programs. The campaign is focused on information about new water safety and rescue equipment, primarily targeting young men and parents. This regional campaign focuses on 1) outreach materials like video animations, news releases, and social media resources; and 2) water safety and rescue equipment (e.g., life jackets, throw rings, and rescue boards) deployed at Great Lakes beaches. The project team has distributed nearly 2000 pieces of equipment to communities and beaches in Minnesota, Wisconsin, Michigan, Indiana, and Illinois. Many of the beaches receiving equipment are not guarded; therefore, there is no safety equipment and rescues are often dependent on First Responder response times. Having equipment at these beaches could turn a potential drowning into a successful rescue. Additionally, the CurrentSmart.org website hosts outreach materials informed by social science research conducted through the Michigan Department of Environmental Quality, Office of the Great Lakes - Coastal Management Program and the NOAA Coastal Storms Program.

Through this session, attendees will learn about current and future water safety efforts conducted. Additionally, attendees will hear lessons learned from project leaders about the first phase of implementation, such as best practices for engaging local water safety working groups in six states; safety and rescue equipment distribution and maintenance; the initial analysis of social media strategies for the Be Current Smart campaign; and ideas for sustaining a regional water safety network, including Sea Grant, university experts, first responders, non-governmental organizations, as well as state, local and federal government agencies. The project is led by Illinois-Indiana, Michigan, and Wisconsin Sea Grant programs, in partnership with five Coastal Management programs, and Minnesota and Ohio Sea Grant programs. The NOAA Coastal Storms Program is supporting this project.

**COLE, STEVE,** *Chief Information Officer, Great Lakes Commission*

Mr. Cole serves as Chief Information Officer of the Great Lakes Commission (GLC). As a member of the GLC's senior management team, Mr. Cole leads the development and implementation of a strategic vision for converting data on the Great Lakes economy and environment into accessible information: actionable knowledge that better supports decision-making for the future of the Great Lakes including environmental management, economic development, and social and cultural value. Refining and implementing this strategic vision is a collaborative process involving leaders and stakeholders from the private sector, government, academia, the non-governmental community and others. It builds upon the report, "Great Lakes Blue Accounting: Empowering Decisions to Realize Regional Water Values," presented to the Great Lakes governors in April 2014 (http://glc.org/docs/2014-blue-accounting-recommendations-glc/). Prior to joining the GLC, Mr. Cole enjoyed a series of successful executive positions in the private sector creating and managing information services and technology businesses from start-up to market leadership.

**Great Lakes Blue Accounting: Empowering Decisions to Realize Regional Water Values**

*Co-authors: Kathy Buckner, Council of Great Lakes Industries; Tim Eder, GLC; Christine Manninen, GLC; Jennifer Read, University of Michigan Water Center; Paul Seelbach, U.S. Geological Survey, Great Lakes Science Center*

In 2013, the Great Lakes governors and premiers called for a comprehensive approach to monitoring Great Lakes water resources. In response, the GLC convened a binational workgroup with broad expertise from the government, industry, academic and NGO sectors. Building on their collective wisdom, the GLC proposed adoption of Great Lakes Blue Accounting

to the governors at their April 2014 summit in Chicago. The development of an information monitoring, strategy and delivery system that supports achievement of the region's priority water "outcomes" is vital and will be initiated through the Blue Accounting program. The August 2014 drinking water crisis in Toledo, Ohio, highlighted the need for a better system of monitoring, which, tied together with information about the quality and status of municipal water infrastructure, could provide greater predictability and vital information to anticipate, prevent and assist with response efforts in such emergencies. The priority "outcome," in the case of Toledo, is safe and sustainable municipal water services. A Municipal Water Supply pilot is currently being implemented for the Blue Accounting program. The full Blue Accounting report is accessible at glc.org/docs/2014-blue-accounting-recommentations-glc.

**Enhancements to myBeachCast mobile app**

*Co-authors: Christine Manninen, GLC; Ed Verhamme, LimnoTech*

myBeachCast is a beach discovery tool as well as a way to get immediate information about weather and water conditions at more than 2,000 beaches in the Great Lakes region. To help protect swimmers from dangerous currents, myBeachCast now features beach hazard statements issued for Great Lakes beaches by the National Oceanic and Atmospheric Administration (NOAA) National Weather Service when high winds and waves, and strong and dangerous currents are present or forecasted. The app, updated hourly, also connects to health department databases across the region to alert users of contamination advisories. myBeachCast is also working to add local lifeguard reports and beach flag status information to the app through a pilot project with Silver Beach County Park in Berrien County, Michigan. The Great Lakes Commission – in partnership with the Great Lakes states and LimnoTech – has developed myBeachCast to provide convenient, public access to swim advisories and related environmental conditions for public beaches in the Great Lakes region. The app also includes real-time and forecasted weather and lake conditions, and nearshore marine forecasts. For additional information, visit beachcast.glin.net. Funding for the beach app enhancements comes through a grant from the NOAA Coastal Storms Program.

**COOK, CHAD,** *Natural Resources Educator, University of Wisconsin – Extension*

Chad is a Natural Resources Educator with the University of Wisconsin-Extension. He works across Northeast Wisconsin on a variety of water quality issues, helping community, agency, and conservation partners engage in effective dialog about the challenges and opportunities facing our water resources. Chad's recent work has centered on providing outreach and engagement support to several total maximum daily load (TMDL) processes and two Great Lakes Areas of Concern (AOCs). In addition, he supports statewide outreach on nonpoint source phosphorus reduction strategies, including water quality trading, adaptive management, and watershed planning.

**Green Bay Ecosystem Modeling: Stakeholder Input and Management Analysis Tool Implications**

*Co-authors: Ed Verhamme, LimnoTech; Joseph DePinto, LimnoTech; Kevin Fermanich, University of Wisconsin-Green Bay; J. Val Klump, University of Wisconsin-Milwaukee*

Recent research on Green Bay has resulted in the development of an ecosystem model that draws from both watershed and climate models to help researchers and managers understand these interactions and identify management actions that could improve water quality conditions. A Management Analysis Tool (MAT) was developed to help decision makers and end users interface more effectively with the powerful modeling tools. In order to make the MAT most useful for those that would benefit most from its capabilities, input was gathered from key stakeholders to better shape the MAT interface and output features. This presentation will highlight the public engagement process that guided the development of the MAT and discuss opportunities for integrating the MAT into a number of ongoing water quality improvement efforts such as the Lower Fox River Total Maximum Daily Load (TMDL) implementation and the Lower Green Bay and Fox River Area of Concern (AOC) restoration.

**CROSS, JAMIE,** *Adopt-a-Beach™ Manager, Alliance for the Great Lakes*

Jamie has been with the Alliance since 1999. Her role with the Alliance is to oversee the day-to-day operations of the Adopt-a-Beach™ program in which volunteers participate by removing marine debris from coastal areas and record their findings into an online Adopt-a-Beach™ system. Under Jamie's leadership the Adopt-a-Beach™ program grew from the once a year International Coastal Cleanup in Michigan and Illinois to a year-round program. Now active in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, the Adopt-a-Beach™ program engages nearly 15,000 volunteers throughout the region annually. She has also played a lead role in

development of the Great Lakes Marine Debris Action Plan by working in partnership with the National Oceanic and Atmospheric Administration to convene stakeholders and facilitate the development of the action plan.

**Abundance and environmental drivers of anthropogenic litter on 5 Lake Michigan beaches**

*Co-authors: Timothy J. Hoellein, Department of Biology, Loyola University; Meagan Westhoven, Department of Biology, Loyola University; Olga Lyandres, Alliance for the Great Lakes*

The abundance and environmental drivers of anthropogenic litter (i.e., trash; AL) in marine habitats is well studied, but freshwater research lags behind. The Adopt-a-Beach™ (AAB) program, administered by the Alliance for the Great Lakes, directed volunteer litter collection on Great Lakes beaches since 1991. Our first study analyzed AAB records for five Lake Michigan beaches that span a population gradient to quantify AL density, infer AL sources, and characterize seasonality. Human population density was positively related to AL density. Over 72% of AL was smoking and food-related, indicating most AL originated from activities occurring on or near the beaches. AL was most abundant in fall, suggesting beach maintenance might reduce AL in summer.

Our second project analyzed AAB data at 214 Lake Michigan beaches to examine relationships between AL and river mouth proximity, fishing activity, and population density. Unexpectedly, AL abundance was unrelated to river mouth proximity and near-shore fishing activity. Like our first assessment, data showed AL increased with county population density, and consisted mostly of food and smoking-related items from beach visitors. This supports our initial analysis related to five Lake Michigan beaches: the majority of AL originates directly on or adjacent to the beaches.

We can assume higher populations in counties surrounding beaches lead to more beach visitors, leading to more AL. Measurements of beach visitor population would be more useful than population density, but are unavailable. Results from the analyses will guide refinement of protocols for AL removal and prevention on Great Lakes beaches and elsewhere. Litter mitigation should focus on beach-goer behavior which generates food- and smoking-related AL.

**DAVID, SOLOMON,** *Postdoctoral Research Associate, Shedd Aquarium*

Dr. Solomon David joined Shedd in 2012 as a postdoctoral research associate in the Daniel P. Haerther Center for Conservation and Research. His work focuses on migratory patterns of nearshore fishes in Lake Michigan and the importance these migrations play in Great Lakes ecosystems. Dr. David's work is part of a joint position between Shedd and the University of Wisconsin, Madison Center for Limnology. He comes to Shedd from a postdoctoral research fellowship at the University of Michigan School of Natural Resources & Environment, where he studied aquatic conservation ecology and sustainable aquaculture. Dr. David holds a master's degree and doctorate from the University of Michigan, where he studied conservation ecology of Great Lakes fishes, including projects focused on lake trout, Chinook salmon and the spotted gar.

**Characterizing Great Lakes Migratory Fish Species: Basin-wide Patterns and New Discoveries**

*Co-authors: Matthew Herbert, Mary Khoury, Patrick Doran, and Eugene Yacobson, The Nature Conservancy; Ashley Moerke; Lake Superior State University; Peter McIntyre, University of Wisconsin – Madison Center for Limnology*

The Laurentian Great Lakes are comprised of a variety of aquatic habitats and diversity of fishes, nearly 200 species, many of which make seasonal spawning migrations connecting ecosystems. Aside from game species, many Great Lakes migratory fishes are understudied, nor are their distributions and life history traits comprehensively documented. To categorize the life history variation among native and exotic migratory fishes of the Great Lakes, we surveyed literature, field reports, and polled Great Lakes fishes experts to generate a comprehensive list of 55 species, focusing only on spawning migrants. We then created a "trait matrix" of 25 life history characteristics (e.g. iteroparous versus semelparous, facultative versus obligate migrants) classifying Great Lakes migratory species. To better understand the distribution of Great Lakes migratory species, we developed a presence-absence map of migratory species by coastal watershed for the entire Great Lakes region. Finally, we focused on several "migratory hotspots" in the Great Lakes region to compare and describe localized biodiversity, phenology, and habitats. We will also highlight findings from our field sampling for migratory Lake Whitefish and impacts of barrier removal on Northern Pike in the Green Bay watershed. Our study provides a comprehensive overview of the diversity, life history, and distribution of Great Lakes migratory fishes. Because these species traverse and connect a variety of aquatic habitats, they can serve as environmental indicators of ecosystem health; therefore, understanding their life history and distribution are important components of conserving biodiversity in the largest surface freshwater system on Earth.

**DODSON, MEGAN,** *Meteorologist, National Oceanic and Atmospheric Administration, National Weather Service*

Megan Dodson is a Meteorologist from the National Weather Service, passionately involved in water safety efforts across the Great Lakes. Dodson managed the beach hazards program at the Marquette, Michigan, Forecast Office through 2014, and then joined the Beach Hazards Program at the Northern Indiana Office. She maintains the Great Lakes Current Incident Database, a record of current-related fatalities and rescues across the region, and uses this data to improve forecasting, outreach, and education related to dangerous currents and waves. Dodson was awarded the 2014 Van Snider award for exemplary partnership with Michigan Sea Grant. As part of several collaborative projects, she used the database to help Sea Grant develop new outreach materials and provide support for water safety efforts and funding across the Great Lakes. Her passion is educating people about weather and water safety, and working with key decision makers in the community to protect life and property.

**Applications from the Great Lakes Current Incident Database: Beach Safety & Forecasts**

Each summer there are an average of 11 fatalities and 25 rescues due to dangerous currents on the Great Lakes. The National Weather Service maintains the Great Lakes Current Incident Database, a 14 year archive of current-related incidents. Case studies were completed on over 450 current related incidents to learn about where and when dangerous currents form in order to improve National Weather Service beach hazards forecasts and statements. Victim demographics were also collected to improve beach safety outreach and education efforts. The Great Lakes see millions of visitors each year at State Parks alone, most within a 3-4 month period in the summer. The key to keeping these beachgoers safe is knowledge. Beach managers and others in the water safety community need to understand where, when, and why dangerous currents form so that they can consistently communicate the risk to the public and designate safe places and best practices for swimming at their local parks. This presentation will give an overview of the Great Lakes Current Incident Database statistics, and cover National Weather Service decision making tools such as beach forecasts, statements, and webpages.

**DURIS, JOSEPH W.,** *Water Quality Specialist, U.S. Geological Survey (USGS), Michigan-Ohio Water Science Center*

Joe Duris received his MS in Biological Science from Western Michigan University. He has worked for the USGS at the Michigan Water Science Center in Lansing, Michigan, for the past 13 years. In 2011, he became the Center's Water Quality Specialist and now oversees study design, data quality, and reporting for USGS water-quality studies around the state and region. Joe's research interests include understanding how human practices, including agriculture and urbanization, affect the occurrence, distribution, fate and transport of nutrients, sediment, trace organic compounds, and bacteria in surface water. Joe also leads a USGS team that is researching how contaminants delivered to the Great Lakes impact the formation and cessation of harmful algal blooms.

**Chemicals of Emerging Concern: Findings from Monitoring of Tributaries of Lake Michigan**

*Co-authors: Steven R. Corsi; Peter L. Lenaker; Austin K. Baldwin; Angela K. Brennan; Brett A. Hayhurst*

Many tributaries to Lake Michigan have a history of contamination from legacy contaminants (heavy metals, polychlorinated biphenyls [PCBs]); however, additional "contaminants of emerging concern" are present in these tributaries as well (wastewater contaminants, organic carbon, pathogens). From 2010 through 2014, the USGS, as part of the Great Lakes Restoration Initiative, sampled 17 tributaries to Lake Michigan. All sites were sampled in 2010 and again in 2014 using passive sampling devices, including polar organic chemical integrative sampler (POCIS) samplers that monitor potentially-toxic hydrophilic contaminants and semi-permeable membrane devices (SPMDs) designed to mimic biological membranes, such as fish gills. Additional samples were collected at a sub-set of sites monthly during base-flow and high-flow conditions and analyzed for chemicals of emerging concern.

In 2010, passive sediment traps were installed at seven Lake Michigan Areas of Concern (AOCs). The sediments were analyzed for over 150 constituents, including polycyclic aromatic hydrocarbons (PAHs) and total PCBs. Findings from these USGS monitoring programs will be summarized and presented for sites draining to Lake Michigan, and put in context with the other 42 tributaries that were monitored in the Great Lakes basin. Variability in chemistry and in pathogen occurrence appears to be related to land-use and river discharge, but in some cases chemical variability is unique to individual sites. Initial findings indicate that there are multiple classes of contaminants present in Lake Michigan tributaries at levels of concern including PAHs, pharmaceuticals, and pesticides. The information collected, as a part of the Great Lakes Restoration Initiative, may be used by water managers to focus restoration goals and act as a measure to overall efforts of restoration in Lake Michigan.

**ELLIOTT, ROBERT F.,** *Lake Sturgeon Coordinator, U.S. Fish and Wildlife Service, Green Bay Fish and Wildlife Conservation Office*

Rob has been a Great lakes Fishery Biologist with the US Fish and Wildlife Service since 1993 and currently works out of the Green Bay Fish and Wildlife Conservation Office. His current work focuses on coordinating the Service's work with lake sturgeon rehabilitation on Lake Michigan where he has worked with numerous biologists and researchers from other agencies and institutions on projects focusing on status assessments, movement, genetic structuring and mixed stock analysis, historic distribution, early life history, habitat evaluation and protection, fish passage development, and on development of streamside rearing for lake sturgeon in Lake Michigan. He has co-authored or authored numerous peer reviewed publications focusing on lake sturgeon and also lake trout and salmon fisheries and biology in the Great Lakes. Rob is an active participant in the Great Lakes Fishery Commission's Lake Michigan Technical Committee and many of its subcommittees and served as chair of the Lake Michigan Lake Sturgeon Task Group.

**Lake Sturgeon Passage on the Menominee River - a habitat based partnership**

*Co-authors: Rory Alsberg, Eagle Creek Renewable Energy; Denny Caneff, River Alliance of Wisconsin; Mike Donofrio, Wisconsin Department of Natural Resources; James Fossum, River Alliance of Wisconsin/Michigan Hydro Relicensing Coalition; Darren Kramer, Michigan Department of Natural Resources; Kyle Krueger, Michigan Department of Natural Resources*

Lake Michigan supports at least 9 naturally reproducing populations of lake sturgeon that migrate up major rivers to spawn. These rivers provide important rearing habitat that young sturgeon use before they migrate downstream into coastal waters of Lake Michigan. The largest of these populations spawns in the Menominee River. Prior to the construction of dams in the mid-1800s, sturgeon could migrate 132 kilometers up and down the Menominee River and spawn at several major rapids. Today, this river section is impounded by 5 hydroelectric dams, the first two located 4.3 and 6.1 Km from the river mouth. Habitat inventories conducted in 2004-5 quantified contemporary spawning and juvenile rearing habitat in the Menominee and in 5 other Lake Michigan sturgeon rivers. While spawning and juvenile rearing habitat is abundant in the Menominee River upstream of the lower two dams, juvenile habitat below these dams is much less abundant than in other rivers. This lack of access to juvenile habitat is believed to be limiting recovery of the Menominee River sturgeon population. Reestablishing an effective migration route around the lower two dams is expected to increased production of young fish that should lead to a significant increase in abundance of adult sturgeon in the Menominee River population. Construction of an upstream fish elevator and downstream fish bypass were completed in spring of 2015 and are now being used to seasonally pass adult sturgeon upstream and provide a route for all fish to pass downstream around the lower 2 dams on the Menominee River. A three year study to evaluate up and downstream movement and behavior of adult sturgeon passed upstream is ongoing that will fine tune ongoing passage operations intended to increase abundance of this important Lake Michigan sturgeon population.

**ESTILL, JENNFIER,** *Owner and Creative Director, Redhead Design Studio*

Jennifer Estill is owner and creative director of Redhead Design Studio—a strategy, marketing and creative development shop in Old Town, Lansing. There, she helps build brands and advocacy campaigns that speak to audiences in meaningful ways.

She believes the best communications and marketing solutions are found at the intersection of critical thinking, strategy, creativity and logic. Jennifer has served a variety of clients in both the for-profit and non-profit sectors, such as Michigan Fitness Foundation, Michigan State University, and Natural Resources Defense Council. Her work has garnered numerous awards for creativity and excellence.

At her core, Jen is a grassroots activist and community developer—building neighborhoods where there are none, conceptualizing events that create a sense of place, and championing the micro-infrastructures that make a city livable and family-friendly. Jen graduated from Michigan State University with a degree in Journalism.

**Raising Public Awareness of Ecological Issues through the Love Lake Michigan Campaign**

*Co-presenter: Todd Parker, Senior Manager, Delta Institute*

Social media campaigns, using Twitter, Instagram and Facebook, are becoming the preferred means of reaching a large number of people with information. Many environmental organizations talk about having a social media presence, but do very little to leverage that presence. In 2014, the Lake Michigan Forum and Watershed Academy (LMFWA), with funding from the Great Lakes Restoration Initiative, launched the "Love Lake Michigan" campaign to promote the inherent value of Lake

Michigan. This social media focused, public engagement campaign encourages individual and collective action toward implementation of Lake Michigan Lakewide Action and Management Plan (LAMP) priorities. Key elements of this campaign are the #LoveLakeMichigan hashtag and the Love Lake Michigan (www.lovelakemichigan.org) web site. This site is the primary entry point for citizen engagement. Through social media, marketing materials, and personal outreach at local events, the LMFWA is driving citizens to this site, where they can view the Lake Michigan 101 training modules, volunteer for community events, provide feedback to EPA on Lake Michigan LAMP priorities, and take the "I Love Lake Michigan" pledge for Lake Michigan stewardship. This campaign continues to increase public awareness of issues related to the water quality of Lake Michigan, expand the range of opportunities for Great Lakes stakeholders and citizens to provide input to the governments and participate in Great Lakes issues and concerns and catalyze individual and collective action toward ecosystem stewardship. In this workshop, the Lake Michigan Forum will discuss the creation, branding, management, implementation and impact of this social media campaign. We will present a variety of media and discuss how we have been able effectively harness the power of social media to increase awareness of the inherent value of Lake Michigan. We will also discuss how organizations can creatively and effectively brand their outreach campaigns for maximum exposure.

**EWERT, DAVE,** *Senior Conservation Scientist, The Nature Conservancy*

**Lake Michigan islands: A biodiversity and conservation overview**

The 32,000 islands of the Great Lakes are the largest collection of freshwater islands in the world. The Great Lakes islands are outstanding in biological diversity, including the 726 islands in Lake Michigan. They are important areas for colonial nesting waterbirds, harbor unique assemblages of plants and animals, and provide stopover sites for migrating birds. They make a significant contribution to the physical and biological diversity of the Great Lakes and surrounding basin. These islands are biologically unique, and by their very nature, isolated and sensitive to change and also buffered from some threats on the mainland, including some pathogens and invasive species and perhaps climate change.

We established criteria for ranking biodiversity values and evaluated threats to Great Lakes islands. These criteria included tracked species, coastal habitats, and island complexity. We then ranked islands of the Great Lakes and connecting waters basin-wide and by coastal segment. We present a synopsis of our results for Lake Michigan, which appear in Islands of Life, and provide examples how this ranking system can be and has been used by Lake Michigan conservation practitioners to protect these islands.

**EWING, BECKY,** *Associate Director, Rotary Charities of Traverse City*

**Prosperity planning – a new look at the concept of watershed planning beyond dam removal: Boardman River Reborn - Community Lessons in Dam Removal**

**FEDORA, MARK,** *Supervisory Hydrologist, Ottawa National Forest*

Mark Fedora has worked on road-stream crossing issues and aquatic connectivity for nearly twenty years. He has helped to conduct over a dozen workshops on inventory, assessment, prioritization, design, and construction of road-stream crossings. Mark has been a hydrologist for the U.S. Forest Service for 26 years, with a MS from Oregon State University and a BS from the University of Minnesota.

**Mapping watershed infrastructure vulnerability in the western Upper Peninsula of Michigan**

*Co-authors: Chris Kovala, Environmental Coordinator, Ottawa National Forest; Colin Brooks, Senior Research Scientist, and David Banach, Assistant Research Scientist, Michigan Tech Research Institute*

We used road density and weighted hydrologic soil groups to map the relative vulnerability of infrastructure in 6th level watersheds of the western Upper Peninsula. We developed a road data set from National Forest data and the Michigan State Framework. Watersheds were assigned a relative vulnerability rating in five categories from very low to very high.

Watersheds with deep sandy soils and low road densities received a very low risk rating, while watersheds with clay soils or shallow to bedrock soils and high road densities received a very high risk rating. The geographic analysis will assist us in prioritizing infrastructure inventories and "right size" road/stream crossings in watersheds with high vulnerability ratings. Our findings showed that watersheds on National Forest lands generally had a higher risk, due to higher road densities. Upon examination of aerial imagery, we observed numerous miles of unmapped roads on other ownerships. We have since mapped 8,000 miles of previously unmapped roads, with an additional 3,300 road-stream crossings, and plan to repeat our watershed infrastructure vulnerability mapping effort to see how the patterns across the landscape may change. Infrastructure vulnerability mapping is an effective tool to help managers prioritize replacement of road-stream crossings in a changing climate while restoring tributary connectivity.

**FERMANICH, KEVIN,** *Professor, Environmental Science and Geoscience, Natural and Applied Science, University of Wisconsin-Green Bay*

Kevin Fermanich is Professor of Environmental Science and Geoscience at the University of Wisconsin (UW)-Green Bay, where he holds the Barbara Hauxhurst Cofrin Professorship of Natural Sciences. Since 2003, Dr. Fermanich has been Director of the Lower Fox River Watershed Monitoring Program, a program involving local, state, federal, and university scientists and managers to assess impairments, sources, and management of runoff pollution. He served on the Lower Fox River Total Maximum Daily Load (TMDL) technical advisory committee and currently serves on the LFR Demo Farms Project advisory team and NEW Water's Silver Creek Adaptive Management Project advisory committee. Dr. Fermanich received his BS degree in soil science from the University of Wisconsin-Stevens Point and MS and PhD degrees in soil science (water resources emphasis) from UW-Madison.

**Nutrient Export to Green Bay under Various Watershed Management and Climate Scenarios**

*Co-authors: Paul Baumgart and Alexis Heim, UW-Green Bay; David Lorenz, UW–Madison; J. Val Klump, UW – Milwaukee*

The Fox-Wolf River watershed supplies more than two-thirds of the total P and sediment load to Green Bay. Phosphorus export from Lake Winnebago to the Lower Fox River is equivalent to more than half (~60%) of the annual export to the lower bay. Point source P discharges represent <20% of the total P load. Similar to many Lake Michigan tributaries, Fox River nutrient loads are closely linked to agricultural land-use intensity and management. In this study, we simulated alternative watershed management pathways under current and projected mid-century climate conditions using linked Soil Water Assessment Tool (SWAT) models for the Wolf River, Upper Fox River, Lake Winnebago, Plum Creek, and Lower Fox River watersheds. More than 15 flow, concentration, and load monitoring stations were used to calibrate and validate the models. Watershed stakeholders provided guidance on various future agricultural management options for the watersheds. We simulated the impact of multiple levels of crop tillage/residue, cover crop, perennial vegetation (including grazing), and nutrient management strategies on sediment and phosphorus export to Green Bay. Nutrient management strategies that stabilize and reduce soil phosphorus levels appear to have the largest impact on overall tributary P export (>20% reductions). Widespread implementation of minimum tillage practices and increased perennial cropping are potential strategies that will greatly reduce (>25%) overall sediment loads. Various SWAT modeling scenario outputs were incorporated into a decision support tool to inform end users and assist decision makers in watershed and AOC management efforts. Under both current and future climate scenarios, field and watershed-wide management systems that reduce the vulnerability of the landscape to nutrient losses during intense precipitation and runoff events are critical to meeting restoration goals for the Green Bay ecosystem.

**FONTENELLE, SAMANTHA,** *Lieutenant Commander, U.S. Environmental Protection Agency*

Lieutenant Commander Samantha Fontenelle is an Environmental Protection Specialist with the U.S. Environmental Protection Agency (U.S. EPA), Office of Water, Office of Science and Technology. Her current duties include supporting the U.S. EPA's fish and beach programs. Prior to joining the U.S. EPA, Lieutenant Commander Fontenelle worked in the private sector as a contractor to the U.S. Department of Energy. Lieutenant Commander Fontenelle has a Masters of Public Health from The Johns Hopkins University and a Masters of Arts in Environmental Studies from the University of Illinois at Springfield.

**Six Key Steps for Developing and Using Predictive Tools at Your Beach**

*Co-author and presenter: Dr. Joanna Mott, Professor of Biology and Chair of Life Sciences Department, Texas A&M University – Corpus Christi*

To reduce exposure to waterborne pathogens at bathing beaches, beach managers need tools that can provide a quick, reliable indication of water quality conditions. The U.S. EPA encourages the use of predictive tools to make timely beach notification decisions and to deliver same-day notifications. To help states and tribes with developing and implementing predictive tools at the beaches, the U.S. EPA developed a simple "How To" Guide based on input from seven beach managers who have successfully implemented a predictive model at their beaches. The beach managers were interviewed to understand the process that each used in developing his/her model. The draft guidance was pilot tested by the Texas Beach Watch Program to assess the utility of the guidance. While predictive tools have been shown to work well at some beaches, the development and implementation of predictive tools for use at coastal beaches remains a challenge for most beach programs.

**FRANCY, DONNA,** *Hydrologist, U.S. Geological Survey*

Donna Francy is the water-quality specialist with the U.S. Geological Survey (USGS) Ohio Water Science Center in Columbus, Ohio. She received a Bachelor's degree in Biology from Indiana University and a Master's degree in Environmental Science from Rice University, Houston, Texas. She has over 20 years' experience in environmental microbiology with prior experience as a clinical microbiologist. At the USGS, she has been serving as project chief on studies that address developing and implementing predictive models for nowcasting recreational water-quality advisories at inland and coastal beaches. Recently, she has focused research efforts on understanding what triggers toxin production from cyanobacterial harmful algal blooms (cyanoHABs) in recreational and source waters and determining what factors and tools can be used to help support predictive capabilities for cyanoHABs.

**Factors Related to Microcystin Concentrations at Ohio Recreational Lakes**

*Co-authors: Jennifer Graham, Erin Stelzer, Christopher Ecker, Keith Loftin, and Amie Brady, USGS; and Pamela Struffolino, University of Toledo*

Cyanobacterial harmful algal blooms (cyanoHABs) and associated toxins, such as microcystin, are a major global water-quality issue. CyanoHAB prediction is complicated and site-specific because of the many factors affecting toxin production, but it is an important goal for public health protection. Monitoring and evaluation of environmental factors that affect the cyanobacterial community may be used to predict the occurrence of cyanoHABs. Samples were collected at Ohio recreational lakes during May–November in 2013–14. Physical parameters were measured at the time of sampling, and composite samples collected from the swimming area were analyzed for nutrients, toxins, phytoplankton abundance and biovolume, and cyanobacterial genes. Weather, hydrologic, and water-quality data were evaluated for use as factors in daily and long-term predictive models. Continuously-measured factors and available environmental data are used for daily predictions of elevated toxin concentrations that do not require a site visit. Results from samples collected and analyzed in a laboratory along with daily factors are used for long-term (a few days to several weeks) predictions. Throughout each season, the cyanobacterial community and the dominant taxa associated with peak microcystin concentrations were unique to individual lakes. Statistically significant correlations between microcystin concentrations and factors for daily predictions included phycocyanin, turbidity, pH, discharge from a nearby river, and Secchi depth. The cyanobacterial genes that were most significantly correlated to microcystin concentrations were different among the lakes sampled. For long-term predictions, concentrations of several nutrients were significantly correlated to microcystin concentrations. The results of this study showed that environmental factors are promising for use in site-specific daily or long-term predictive models for cyanoHABs at recreational areas. Future studies should focus on collecting more frequent data on 3-4 consecutive days each week and applying a statistical method, such as multiple-linear regression, to develop models to nowcast or forecast toxin concentrations.

**FRANK, KENNETH A.,** *Professor of Sociometrics, Measurement and Quantitative Methods and Professor of Fisheries and Wildlife, Michigan State University*

**Diffusion and Transformation of Knowledge about Climate Change through Social Networks in the Great Lakes Region**

*Co-authors: Tingqiao Chen, I-chien Chen, Yun-jia Lo, and Ran Xu, Michigan State University*

We will present three phases of analyses of social networks as they relate to the diffusion of knowledge and policy orientated behavior in the Great Lakes region. Phase I (data from 1997-2009): We identify a network based on who co-authored policy documents about climate change in the Great Lakes region, finding that those who bridged between clusters in the network were more likely to engage in policy oriented behaviors. Phase II (data from 2009-2013): We define a network based on participation in events (e.g., conference calls, miniconferences) about climate change in the Great Lakes region. We find that location in the social space of this network is related to beliefs about the future of lake levels, but not freeze-thaw cycles, in the Great Lakes. Phase III (data from 2013): We identify networks of close colleagues (from survey responses) among stakeholders and affiliates of the Alliance for the Great Lakes who focus on ravine management. We then interpret the diffusion of practices associated with ravine management relative to the close colleague network, finding that one of the actors in Phase II plays a key role in the diffusion of information about climate change among the stakeholders in Phase III.

This set of analyses offers the potential to track the diffusion of knowledge about climate change, beginning with interactions among regional scientists and policy-makers, through intermediaries, to stakeholders whose exposure to knowledge may change their day-to-day actions.

**GERIG, BRANDON,** *PhD student, Department of Biological Science, University of Notre Dame*

Brandon Gerig is a U.S. Environmental Protection Agency STAR Research Fellow and is advised by Drs. Gary Lamberti and Dominic Chaloner. Prior to his doctoral work, Brandon was a fisheries biologist with the Utah Division of Wildlife Resources where he worked to rehabilitate native fish as part of the Upper Colorado River and San Juan River Recovery Programs. From 2009-2011, he conducted a master's thesis at the University of Florida studying the effects of dam operations on native fish in the Colorado River in Grand Canyon. As an undergraduate Brandon conducted research on sturgeon and salmon populations throughout the Great Lakes and Alaska while attending Lake Superior State University.

**Contaminant Biotransport by Pacific salmon to Lake Michigan Tributaries**

*Co-authors: Dr. Dominic T. Chaloner, Department of Biological Sciences, University of Notre Dame; Dr. Dave J. Janetski, Department of Biology, Indiana University of Pennsylvania; Dr. Rick R. Rediske, Annis Water Resources Institute, Grand Valley University (GVSU); Dr. Ashley H. Moerke, School of Biological Sciences, Lake Superior State University; Dr. Jim McNair, Annis Water Resources Institute, GVSU; D.A. Pitts, Center for Research Computing, University of Notre Dame*

The Great Lakes are ideal systems for evaluating the synergistic components of environmental change, such as exotic species introductions and legacy pollutants. Introduced Pacific Salmon (Oncorhynchus spp.) represent an intersection of these drivers because they are non-native species of economic importance that bioaccumulate contaminants during the open water phase of their life cycle. Furthermore, Pacific salmon can deliver a significant pulse of contaminated tissue to tributaries during spawning and subsequent death. Thus, salmon represent a key pathway by which contaminants accumulated in Lake Michigan are transported inland to tributaries that otherwise lack point source pollution. Our research has revealed that salmon exhibit basin-specific persistent organic pollutant (POP) and mercury (Hg) concentrations reflecting pollutant inputs from both current and historic sources. Overall, Lake Michigan salmon were more contaminated with POPs and Hg than conspecifics from Lakes Huron or Superior. Consequently, Lake Michigan salmon pose a higher risk and magnitude of contaminant biotransport and transfer. Resident stream fish (e.g., brook trout) sampled from salmon spawning reaches had higher pollutant concentrations than fish sampled from upstream reaches lacking salmon, but the extent of fish contamination varied among lake basins and streams. In general, Lake Michigan tributaries were the most impacted, suggesting a direct relationship between the extent of salmon-derived contaminant inputs and resident fish contaminant levels. Within and among lake basins, contaminant biotransport by salmon is context dependent and likely reflects a suite of ecological characteristics such as species identity and trophic position, dynamics of the salmon run, watershed land-use, and instream geomorphology such as sediment size. We suggest that future management of salmon-mediated contaminant biotransport to stream communities in the Great Lakes basin should consider biological, chemical, and physical factors that constitute the environmental context.

**GIBBONS, ELIZABETH,** *Director, University of Michigan Climate Center and Program Manager, Great Lakes Integrated Sciences + Assessments (GLISA)*

Beth Gibbons is the director of the University of Michigan's Climate Center and the Program Manager of GLISA, National Oceanic and Atmospheric Administration's Great Lakes regional center. In both roles, her core responsibilities include fostering the transfer of information on climate change and resilience from the research community to stakeholders throughout the region and sharing best practices across practitioner communities. Beth holds a graduate degree in Urban and Regional Planning from the University of Michigan and has worked in the U.S. and Africa on a variety natural resource management, community, and economic development initiatives.

**Climate Data Localization and Resources for Great Lakes Communities**

*Co-authors: William Baule, Daniel Brown, and Laura Briley, GLISA*

GLISA, a cooperative effort between the University of Michigan and Michigan State University, functions as a bridge between climate science researchers and boundary organizations in the Great Lakes region, with the goal of contributing to the long-term sustainability of the region in face of a changing climate and to facilitate smart decision-making backed by sound scientific knowledge. From a community/regional standpoint, making climate information relevant at the local level is key to stakeholders and decisions makers. This process is not trivial, as climate information in its raw form is often above the local scale. The process to localize the information for each community/region is an iterative process between GLISA staff and practitioners in the boundary organization that identifies the unique interests of each group and tailors a summary to suit their specific needs. This presentation will detail the process for the localization of climate data for two past GLISA-supported projects. The first community is the Sault Ste. Marie Band of Chippewa Indians. The second is an area of ravines along western shore of Lake Michigan between Chicago and Milwaukee. Also to be presented will be the University of Michigan Climate Center's Cities Impacts and Adaptation Tool (CIAT) and how this tool can be used to access localized information. The CIAT allows decision makers at the city level to access information such as: demographics, socioeconomic data, and historical and projected climate information and trends. Using this information, decision-makers are able to identify a network of climate peers whose current climate reflects the projected climate for the specified location. Decision-makers, through the CIAT, also have access to a database of existing climate action plans from across the country to incorporate existing knowledge in their own operations.

**GOWARD, KELLY,** *Macatawa Watershed Project Manager, Macatawa Area Coordinating Council*

Kelly Goward has been the Macatawa Watershed Project Manager and the Macatawa Area Coordinating Council since August 2012. Kelly works with numerous local partners to plan and coordinate the implementation of best management practices and outreach and education efforts in the Macatawa Watershed, as well as provide stormwater permit assistance to six local entities. She spent 8 years prior to 2012 working for the Ottawa and Allegan Conservation Districts as a forest and wildlife resource professional and later transitioned into watershed project management. Kelly has a B.S. in Biology from Grand Valley State University and an M.S. in Natural Resources Management from Ball State University. Kelly is actively involved with the Michigan Chapter of the Soil and Water Conservation Society and Michigan Envirothon.

**Agricultural Collaboration in the Macatawa Watershed**

The Macatawa Watershed is a small watershed in southwest Michigan plagued by excess sediment and phosphorus. The watershed contains numerous streams and ditches that originate in agricultural areas and make their way through the urbanized heart of the watershed and into the Macatawa River. The river opens up into Lake Macatawa, a drowned river mouth that enters Lake Michigan near Holland. The Macatawa Watershed Project was formed at the Macatawa Area Coordinating Council in 1999 to address the development and implementation of a phosphorus reduction plan per a U.S. Environmental Protection Agency approved phosphorus total maximum daily load (TMDL). Over the years, numerous "random acts of conservation" were implemented in both the urban and agricultural areas of the watershed; however, the TMDL remains in effect today. An aggressive research project was initiated in 2010 to study the sources of sediment and phosphorus in the watershed in order to better target implementation efforts. The results of the research led to a private-public initiative titled Project Clarity that aims to raise funds and target implementation projects in areas of the watershed that need it most. A major component of Project Clarity was the establishment of an Agricultural Advisory Committee comprised of local producers and representatives of agribusiness. This group reviews proposed agricultural projects and makes funding decisions. The group is advised by staff at the Macatawa Area Coordinating Council, the entity in charge of the

phosphorus TMDL implementation plan, and the Outdoor Discovery Center Macatawa Greenway, who serves as the fiduciary for Project Clarity. This collaborative effort has brought together the agricultural community with private and public partners in a unique way that has created a synergy that is unprecedented in the history of the watershed project. This presentation will briefly outline the Macatawa Watershed Project and discuss our current efforts within the agricultural community.

**GRIMM AMANDA,** *Assistant Research Scientist, Michigan Technological University – Michigan Tech Research Institute*

Amanda Grimm is an Assistant Research Scientist at Michigan Tech Research Institute (MTRI), Michigan Technological University. She is a spatial ecologist interested in applying remote sensing and spatial analysis techniques to complex environmental questions. Amanda received an MS in Natural Resources & Environment from the University of Michigan, where she was part of the SNRE Environmental Spatial Analysis Lab, and is a graduate of Michigan State University, where she earned a BS in Environmental Zoology. Current research interests include remote sensing of nearshore aquatic habitats and especially aquatic invasive species, ocean color remote sensing, and Great Lakes coastal change.

**Remote Sensing for Great Lakes Mapping and Monitoring**

*Co-authors: Robert Shuchman, Michael Sayers, Colin Brooks, Laura Bourgeau-Chavez, Michigan Tech – MTRI*

Remote sensing provides a method to accurately assess and monitor many aspects of water quality, ice cover, habitat, and coastal change for large lakes such as Lake Michigan. Satellites and aerial vehicles with optical, thermal, and microwave sensors collect data that span large geographic areas and have been in operation for over a decade and sometimes much longer. These long-term data sets, once processed and classified into products, allow the analysis of time series data to determine how water quality and ecosystem conditions have changed, particularly in the light of a changing climate. This presentation reviews a variety of methods/products produced by Michigan Tech Research Institute that aid in environmental monitoring of the Great Lakes, including assessment of water quality, harmful algal blooms, lake temperature, ice cover, nearshore bathymetry, invasive species distributions, and shallow aquatic habitats. Access to these datasets will also be discussed. MTRI is active in developing and applying user-friendly web portals for sharing Great Lakes remote sensing data and derived products.

**Mapping Submerged Aquatic Vegetation in the Great Lakes Using Satellite Imagery**

*Co-authors: Colin Brooks, Robert Shuchman, Michael Sayers, Amanda Grimm, Michigan Tech – MTRI; Martin Auer, Michigan Tech*

Under U.S. Environmental Protection Agency GLRI funding, the Michigan Tech team has developed and verified a remote sensing algorithm to map the extent of Cladophora and other submerged aquatic vegetation (SAV) in the nearshore zone of the Great Lakes using an index that corrects for the effect of water depth. With this algorithm, maps of SAV were generated from recent Landsat satellite imagery for all areas of the lower four Great Lakes that are shallow enough to detect the lake bottom. The area mapped varies depending on water clarity, with maximum mapping depth ranging from >20 m in Lake Michigan to 7 m in Lake Erie. The maps show that 28%, 15%, 30%, and 40% of the visible bottom of Lakes Michigan, Huron, Erie and Ontario, respectively, are colonized by SAV. The total mapped area of SAV is estimated to represent between 130,000 and 260,000 metric tons dry weight based on published biomass density measurements. This new mapping approach was validated using field data for an overall map accuracy of 83%. The archive of Landsat imagery, dating back to 1973, was also utilized to document historic changes in SAV extent and water clarity, showing increases in SAV extent in most areas following the introduction of invasive mussels. The time series analyses also captured the observed increases in water clarity in all four lakes. Overall, the effects of invasive zebra and quagga mussels on water clarity and phosphorus availability in the Lakes are enabling benthic vegetation to grow more densely and in deeper water than was previously possible, resulting in nuisance blooms even in areas without strong point sources of nutrients. These new maps will support Cladophora management efforts and help to prioritize areas for nutrient abatement programs.

**HAKALA, CINDY,** *Beach Program Coordinator, Minnesota Department of Health*

Cindy Hakala is the Beach Program Coordinator for the Minnesota Lake Superior Beach Monitoring and Notification Program at the Minnesota Department of Health. Cindy recently received her Masters of Environmental Education from the University of Minnesota Duluth. The information presented here was part of her thesis work, which she defended in March 2015.

**Evaluating the Notification and Outreach Efforts of the Minnesota Beach Program**

The Minnesota Lake Superior Beach Monitoring and Notification Program (Beach Program) strives to give people the knowledge and skills necessary to recreate safely in water and practice beach stewardship. A formative evaluation was conducted to assess to what degree the Beach Program has fulfilled its responsibility to notify the public of the services it provides and to make water recreation information available for the protection of human health and environmental health. Surveys were conducted at three Duluth, Minnesota, beaches in August 2014. Beachgoers were asked questions about their knowledge, perceptions regarding risk, preferences for outreach methods and information, and ways that they had received beach advisory notifications in the past.

Seventy surveys were conducted. Less than half of respondents said they had heard of the Beach Program or of beach advisories. Frequent visitors to Lake Superior beaches were significantly more aware of a state water quality monitoring program and beach advisories than first time visitors ($p<.01$). Of participants who had heard of beach advisories for bacteria, the majority had learned of advisories from either TV/news or from signs at the beach. All respondents but one perceived the level of risk of getting sick from swimming in Lake Superior to be low. Over 90% of beachgoers asked for specific information on the "types of illness associated with bacteria." Other popular areas of information desired were "sources of bacteria" and "age-group specific information." Results will be used to improve Beach Program outreach.

**HAMIDI, SAJAD AHMAD,** *Research Associate, University of Wisconsin-Milwaukee*

Dr. Hamidi is a research associate in the civil and environmental engineering department, University of Wisconsin-Milwaukee. His current research is on hydrodynamic and biogeochemical modeling, study of pollutants in lakes and coastal regions, and watershed management. He has been working for several years on developing hydrodynamic modeling framework for Lake Michigan to study the pollution transportation, bacteria, and hypoxia in several parts of the lake especially Green Bay.

**Monitoring Spatial-Temporal Variations of Fox River Plume using MODIS Remote Sensing Imagery**

*Co-authors: Hossein Hosseiny; Nima Ekhtari; Hector Bravo, University of Wisconsin-Milwaukee*

River plumes are a major source of pollutants, nutrients, and sediment into coastal areas. Southern Green Bay supplies one third of the total nutrient loading to Lake Michigan and has been designated as Area of Concern by the U.S. Environmental Protection Agency. The Fox River is the main source of land-based pollutants into southern Green Bay. Identifying the coastal area influenced by polluted river inflows is essential in any management plans and restoration efforts. The evaluation of water quality status is normally based on time-consuming and expensive in situ measurements. Remotely sensed data is an efficient alternative for river plume monitoring because of its spatial and temporal resolution. This study is a first attempt to develop an empirical relationship between in situ measurement of turbidity and suspended sediment, and atmospherically corrected water surface reflectance values obtained from the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard the Aqua satellite. The proposed method shows a reliable performance ($R2=0.87$) in estimation of turbidity and suspended matter in southern Green Bay. The results are used to determine the spatial and temporal variability of Fox River plume. Spatial-temporal variability of river plume is correlated with the Fox River discharge. Cloud contamination of remotely sensed data imposes restrictions on the applicability of the proposed method, especially during floods. Nevertheless, remotely sensed data can be used to produce seasonal maps for distinct water quality parameter concentrations. Collection of new in situ data, especially at the same time of remotely sensed data, will be useful in further validation of the proposed method. This study will improve our knowledge about the spatial-temporal variations of Fox River turbid plume and shows the potential of moderate resolution images in monitoring and assessment of water quality in Great Lakes coastal areas.

**HARTZELL, CHRISTOPHER S.,** *Technical Lead, Collins Engineers, Inc.*

Chris Hartzell is a licensed surveyor in the State of Wisconsin and currently the technical lead for 3D data acquisition systems at Collins Engineers, Inc. He has been working in the Surveying field since 1994 with an extensive background in Land Surveying, 2D and 3D Acoustic Imaging and Hydrographic Surveying. Chris has recently been involved in pioneering field operations and data processing techniques for detailed underwater scanning of structures, from bridge piers to shipwrecks. He has experience with traditional total stations, robotic total stations, GPS systems, stationary and mobile Lidar systems, 2D, 3D and Multi-beam sonars, Coda motion reference systems, AutoCAD, Civil 3D, SketchUp, Leica Cyclone, Trimble Real Works, CloudCompare, Hypack and many others. Chris is currently a member of the Wisconsin Society of Land Surveyors, the National Society of Professional Surveyors, and The Hydrographic Society of America.

**Managing Historic Shipwrecks in Lake Michigan with Mobile Sonar and 3D Modeling**

*Co-authors: Dr. Kira E. Kaufmann, Commonwealth Cultural Resources Group; Roy A. Forsyth, Collins Engineers, Inc.*

In 2015, newer applications of remote sensing technology were employed to better define four archaeological shipwreck sites within Indiana's territorial waters of Lake Michigan. For the first time in the Great Lakes region, a mobile 3D sonar survey was conducted at four shipwreck sites. Additionally, a diver-directed 3D sonar survey was conducted of the interior of one shipwreck, the Material Service, which has substantial superstructure. The Material Service is one of the few, and perhaps the first, historic shipwrecks in the region that has been surveyed using side-scan sonar, diver-directed 3D sonar, and mobile 3D sonar. The historic shipwrecks in this study were investigated using a new application of mobile sonar technology.

Previous archaeological applications of mobile sonar technology have employed remotely operated vehicles (ROV's) to deploy the sonar equipment at stationary locations. Because of the dynamic nature of the southern Lake Michigan basin, this sonar survey was based from a completely mobile platform – a moving vessel – in a manner similar to towed side-scan surveys. However, the sonar head was not towed. Instead, the equipment was mounted directly to the survey vessel. Locational accuracy was maintained using a GPS base station on shore that was connected to the vessel sonar equipment through high frequency antennas.

The resulting three-dimensional data was compiled in two different computer modeling platforms: sonar-generated point clouds and animated web-based 3D computer models. A sonar-generated point cloud model produced accurate and measurable representations of the sites, whereas the animated models provide public access to exam these shipwrecks in a completely innovative way. The resulting compilation of remote sensing technology and computer modeling provides new information about previously unrecognized site limits, site conditions and existing artifacts. These new perspectives allow for better assessment of site conditions as part of a regular management program.

**HOFFMAN, LAUREN,** *Landscape Ecologist, Environmental Consulting & Technology, Inc.*

Lauren Hoffman is a Landscape Ecologist with Master's degrees in Terrestrial Ecosystems and Landscape Architecture with 5 years of experience specializing in habitat restoration, biological assessments, sustainable stormwater management, threatened and endangered species surveys, and invasive species management. Certified Floodplain Manager by the Michigan Stormwater-Floodplain Association and Certified Natural Shoreline Professional by the Michigan Natural Shoreline Partnership.

**Chrysler Beach Restoration: Stormwater Improvements in an Urban Area**

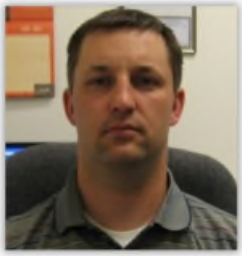
*Co-authors: Annette DeMaria, Environmental Consulting & Technology, Inc.; Barry Kreiner, City of Marysville*

In December 2014, the City of Marysville completed stormwater improvements along the St. Clair River shoreline in order to improve the water quality at Chrysler Beach. Since 2001, the beach had elevated E. coli levels and was subject to periodic closures due to public health concerns. Using a $500,000 grant from the Great Lakes Restoration Initiative (GLRI) with an additional $80,000 in matching effort from staff, the City installed rain gardens and bioswales to filter stormwater runoff from 2.5 acres, reduced the amount of impervious surfaces by 0.7 acres, and added 17,300 square feet of planting beds to deter geese from congregating on the beach. It is expected that these improvements will result in lower E. coli levels in 2015 and beyond.

This project spurred an additional $500,000 in renovations at Chrysler Beach. Concurrent with the stormwater improvements, the City removed a deteriorated fence, seawall and docks that were no longer functional, and outdated outdoor light poles. The City also widened the boat ramp and installed a boat dock to improve usage by boaters. In 2015, the City will install additional recreation amenities funded by a $239,900 grant from the Michigan Natural Resources Trust Fund

and City funds. These amenities include a new bathroom and concession stand, fish cleaning station, umbrellas, picnic tables, and a play scape. In 2015, outdoor lighting and a kayak launch will be reinstalled at the site. Finally, in 2016 the City plans to install a new fishing pier at the site.

This presentation will discuss the design criteria for the green infrastructure, construction challenges, and lessons learned that may be applicable to other beach restoration projects. In addition, the broader vision for the site will be discussed as an example of how GLRI funding is spurring redevelopment in urban areas.



**HORTNESS, JON,** *Chief, Northern Illinois Field Office, U.S. Geological Survey*
Jon Hortness is the U.S. Geological Survey (USGS) Liaison to the U.S. Environmental Protection Agency (U.S. EPA), Great Lakes National Program Office (GLNPO) and in that role helps to manage and coordinate all USGS activities funded under the Great Lakes Restoration Initiative (GLRI). Jon works closely with U.S. EPA/GLNPO and other Federal Agency staff to identify areas where USGS can support restoration activities by providing relevant scientific information.

Jon received his Bachelor's degree in Civil Engineering and Master's degree in Water Resources Engineering from the South Dakota School of Mines and Technology. He is a Registered Professional Engineer and he began working for the USGS in 1996. Before moving to Illinois, Jon spent 9 years in the Idaho Water Science Center performing various surface water investigations related to river and watershed modeling, surface-water/ground-water interactions, flood and drought analyses, and in-stream flow criteria.

**USGS Nutrient Monitoring in Major Tributaries to the Great Lakes**
Excessive nutrient and sediment concentrations and loads have been documented in many tributaries to the Great Lakes. This has resulted in a few of the tributaries in Wisconsin being listed as exceeding phosphorus criteria (Wisconsin is the only state with phosphorus criteria), many of the bays and estuaries being listed as Areas of Concern (AOCs) for eutrophication issues, and large areas of the Great Lakes, especially Lake Erie, having Harmful Algal Blooms (HABs). Many efforts have been made during the first 5 years of GLRI to reduce nutrient and sediment concentrations in streams and rivers that drain watersheds that are dominantly affected by nutrient and sediment sources throughout the Great Lakes Basin, and these efforts will continue during Phase II of GLRI. In order to determine the success of these efforts at improving water quality, it is important to document in a systematic manner the water quality and loading from key tributaries to the Great Lakes. Results of this work will describe the water quality of these tributaries, quantify Key Indicators of GLRI success defined by the U.S. Environmental Protection Agency (changes in phosphorus loading), provide nutrient and sediment data for other GLRI efforts (Areas of Concern and nearshore impact studies) and other non-GLRI scientific studies, and provide data to support Lakewide Action and Management Plans (LAMPs), Remedial Action Plans (RAPs), and State management plans. Consistent data collection techniques are needed to properly document inter-annual variability and evaluate long-term trends in water quality in these tributaries and loading to the Great Lakes.

The objectives of this project are to document streamflow and water quality in key tributaries to the Great Lakes and to calculate the nutrient and sediment loading from these sites. The specific objectives of this study are to: 1) document water quality (nutrients: total and dissolved phosphorus, nitrate plus nitrite, Kjeldahl nitrogen, and suspended sediment) in each of the key tributaries; 2) collect continuous (15-minute) water-quality data (turbidity, temperature, dissolved oxygen, pH, and conductivity) in each of the tributaries; 3) quantify total and dissolved phosphorus, nitrogen, and sediment loading from each tributary using methods defined as part of previous GLRI studies; and 4) provide the water-quality concentrations and loads to other scientists and the public on a continuous basis on the Web.

**HORVATIN, PAUL J.,** *Chief, Monitoring Indicators and Reporting Branch, U.S. Environmental Protection Agency (U.S. EPA) – Great Lakes National Program Office*
Paul Horvatin is the Monitoring, Indicators, and Reporting Branch Chief for the U.S. EPA Great Lakes National Program Office (GLNPO). Paul has been with the EPA for over 30 years. He received his MS from the University of Illinois-Urbana in Environmental Engineering and his BS from University of Illinois-Urbana in Biology. Paul is responsible for indicator development and monitoring programs for U.S. EPA in the Great Lakes including: open lakes monitoring, Integrated Atmospheric Deposition Network (IADN), contaminated fish monitoring, biological monitoring (phytoplankton, zooplankton and benthic), U.S. EPA Research Vessel Lake Guardian management, and health and safety management for GLNPO. He is also the U.S. Co-Chair for the GLWQA Science Annex (Annex 10).

**Lake Michigan 2015 Cooperative Science and Monitoring Initiative (CSMI) Field Year Overview**

*Co-authors: Glenn Warren, Todd Nettesheim, Elizabeth Murphy, Eric Osantowski, and Elizabeth Hinchey Malloy, U.S. EPA Great Lakes National Program Office; Paris Collingsworth, Illinois-Indiana Sea Grant, Purdue University*

The Cooperative Science and Monitoring Initiative (CSMI) was created as the result of a need to coordinate science in support of management of the Great Lakes. The process includes enhanced monitoring and science field activities which are conducted in one lake per year, tied to the needs of the Lakewide Action and Management Plan (LAMP). Lake-specific activities in the other four years are: sample analysis, data interpretation, reporting, LAMP information needs identification and prioritization vetted through the Lake Partnerships, CSMI monitoring and research workplan development, and planning and logistics for the next field year. The 2015 Lake Michigan CSMI implemented an investigations by federal agencies and partners to address key knowledge gaps in: the distribution, abundance and movement of nutrients and biota (e.g., invertebrates and fish) across a nearshore to offshore gradient; status of the lower food web as a detection for ecological change, which included mapping of Dreisennid mussel, *Diporeia*, and total benthos populations; an assessment of organic contaminants in water, pelagic micro-fauna, and benthic invertebrates to understand how these concentrations relate to those measured in Lake Trout; quantification of PCB, mercury, and flame retardant loads for five Lake Michigan tributaries; and an assessment of atrazine concentrations in the open waters to compare with projections made by the Lake Michigan Mass Balance model. The results of the 2015 CSMI field year will be communicated to stakeholders in 2016 and 2017 through GLWQA Annex 10 (Science Annex) and Annex 2 (Lakewide Management) proceedings and reports; this presentation will provide an overview of research highlights from the 2015 field season.

**HOWARD, SHAUN,** *Eastern Lake Michigan Project Manager, The Nature Conservancy*

Shaun Howard is The Nature Conservancy's Eastern Lake Michigan Project Manager. Utilizing the Michigan Dune Alliance partnership framework, he coordinates the restoration of dunes and associated coastal ecosystems along 500 miles of Eastern Lake Michigan shoreline. Shaun is also active in statewide ecosystem restoration efforts, primarily through his work with Cooperative Invasive Species Management Areas and the Michigan Invasive Species Coalition. A Michigan native, Shaun earned a B.S. in Zoology through the Lyman Briggs College at Michigan State University and joined TNC in 2010 to implement invasive plant species control in the parabolic and perched dune systems throughout the Northwest Lower Peninsula.

**The Michigan Dune Alliance: Collaborating to Restore Eastern Lake Michigan Coastal Ecosystems**

The Great Lakes contain the world's largest freshwater dune system, totaling 275,000 acres of perched, parabolic, and linear dunes with the majority of these ecosystems located throughout Eastern Lake Michigan. The nearshore dunal area provides critical habitat to nearly 10% of Michigan's species of concern, while also playing a key role in Michigan's growing eco-tourism economy through the numerous recreation and quality of life benefits it offers. Unfortunately, Eastern Lake Michigan also faces the ongoing threat of habitat degradation, with one of the largest factors being the introduction and proliferation of terrestrial invasive plant species. Since 2007 the Michigan Dune Alliance has utilized a multi-partner collaborative framework to implement landscape-scale invasive plant control across over 500 miles of Eastern Lake Michigan shoreline. These management efforts have resulted in the suppression, control, and eradication of invasive species populations across 50,000 acres of public, private, and conserved coastal land in Eastern Lake Michigan. Future efforts include creating a healthy set of "semi-contiguous" natural areas, incorporating Lake Michigan Island management, and exporting lessons learned to other Great Lakes coastlines.

**HUMMER, JOHN,** *Project Manager/Contractor, Great Lakes Commission*

John Hummer joined the Great Lakes Commission staff in 2001 and now serves as the project manager/contractor for the Lake Michigan Monitoring Coordination Council (LMMCC). He has managed two ecosystem monitoring coordination projects, including the Great Lakes Coastal Wetlands Consortium (2006-2009) and the LMMCC for past 10 years. John holds a Master's degree in Resource Development from Michigan State University and a bachelor's degree from Central Michigan University. In his spare time, John enjoys sports, outdoor activities, travel, photography, and spending time with his family.

**What does the 2015 Lake Michigan Monitoring Inventory tell us?**

Monitoring is a key component of the Lake Michigan LAMP; however, monitoring efforts can be enhanced to be more comprehensive and efficient. The LAMP explicitly states "…Current monitoring challenges in the Lake Michigan basin include: incomplete inventories of federal, state/provincial and municipal observation and monitoring." This presentation will summarize key highlights from a recently completed Lake Michigan monitoring survey and a resulting inventory of monitoring information and metadata conducted by the Lake Michigan Monitoring Coordination Council. An assessment of the results of the inventory and this presentation will identify gaps and make recommendations for improving efficiencies and collaborative monitoring opportunities throughout the basin. The inventory and this presentation will also promote a more effective use of Lake Michigan monitoring data that will result in more informed management decisions and strategies, increased identification and implementation of priority restoration and protection projects, and more cohesive management of monitoring programs and resources. Collectively, our goal is to advance a more effective and efficient monitoring regime and use of monitoring data to help address the Lake Michigan LAMP's goals and objectives.

**HUSCHKE, KATHY,** *Executive Director, Oleson Foundation*

Kathryn Wise Huschke is the current Executive Director for The Oleson Foundation in Traverse City, Michigan. The Oleson Foundation is a private foundation instituted in 1962, and serves the areas of Traverse City, Petoskey, Charlevoix, and Manistee, where the Oleson Food Stores are located. A native of Traverse City, Ms. Huschke graduated from Traverse City Central High School, and received a B.A. in Communications from Michigan State University. She previously held the position of Vice President Program at the Fremont Area Community Foundation in Fremont, Michigan. Ms. Huschke has participated in many non-profit boards and committees, state and national foundation council committees, and is currently serves on the Grand Vision Leadership Team, Boardman River Prosperity Team, and many other task forces and committees. She and her husband John reside in Fremont and Leland, Michigan. They have two grown children: Kate Huschke Glancy is an attorney in Manistee and Griffin is an international policy advisor in Washington D.C.

**Funder's collaborative at work**

Boardman River Reborn - Community Lessons in Dam Removal

**HUTTON, MARGARET,** *Graduate student, Purdue University*

Margaret Hutton has her B.S. in Marine Biology from the University of New England, Biddeford, ME. After working with the US Fish and Wildlife on native species restoration in Lake Huron and Lake St. Clair, Margaret decided to return to school to work towards her graduate degree. She is now working closely with the U.S, Environmental Protection Agency (U.S. EPA), National Oceanic and Atmospheric Administration, and other universities to observe shifts in lower trophic levels throughout Lake Michigan with an emphasis on changes in nearshore locations.

**Long-Term Trends in Nearshore Chlorophyll Concentrations throughout Lake Michigan**

*Co-authors: Paris Collingsworth, Illinois-Indiana SeaGrant Program, Purdue University, U.S. EPA – Great Lakes National Program Office; Tomas Höök, Purdue University, Illinois-Indiana SeaGrant Program; Barry Lesht: University of Illinois-Chicago, CSC and Department of Earth and Environmental Sciences*

Long-term monitoring throughout Lake Michigan has indicated declines in chlorophyll a concentrations in offshore locations (>30 m in depth) due to invasive Dreissenid mussels. By filtering phytoplankton and sequestering nutrients nearshore, Dreissenid mussels have disrupted the transport of nutrients to offshore locations. However, coincident responses in chlorophyll a concentrations in nearshore habitats may not mirror offshore patterns. Previously, monitoring chlorophyll a concentrations in nearshore locations (<30 m depth) was not possible due to logistics in sampling large, dynamic ecosystems. Also, limitations in remote sensing algorithms produced unreliable chlorophyll a concentrations in nearshore areas. Recently, a new algorithm was developed with the ability to estimate chlorophyll a concentrations from images captured by the SeaWiFS and MODIS satellites from 1998 to 2013 for both offshore and very nearshore locations. Estimated chlorophyll a concentrations were compared across specific bathymetric contours along a nearshore to offshore gradient. Due to variations in habitat around Lake Michigan along with seasonal variations, concentrations were averaged seasonally and for five different regions around Lake Michigan. Overall trends in nearshore chlorophyll a concentrations do not mirror the declines offshore and may have increased slightly. Nearshore trends also show variations between seasons and across regions.

**KARNER, CLAIRE,** *Community Planner, Land Information Access Association*
Claire is a Community Planner at LIAA (Land Information Access Association), a non-profit community planning organization based in Traverse City, Michigan. Claire shares the responsibilities of developing and implementing LIAA's community planning projects across the state of Michigan, with a focus on community resilience. She joined LIAA in 2013 and holds a B.A. in Environmental Studies from the University of Michigan and a Masters of Community and Regional Planning from the University of Oregon.

**Building Community Resilience in Coastal Communities**
*Co-author: Harry Burkholder, Planning Director, LIAA*
Explore how Great Lakes coastal communities are integrating regional climate data into local planning efforts. This session will highlight LIAA's land use planning program - Planning for Resilient Coastal Communities - and provide tools for engaging communities to identify vulnerabilities and appropriate adaptation strategies. This presentation will discuss unique issues faced by coastal communities, effective planning in various political landscapes, and ideas for addressing community goals through adaptation planning.

**KHOURY, MARY,** *Aquatic Ecologist and Conservation Planner, The Nature Conservancy*
Mary started with The Nature Conservancy in 1995 and initially worked for the Great Lakes Program and then the organization-wide Freshwater Initiative. Currently, Mary is a member of the Michigan chapter's science team and manages the Aquatic Connectivity strategy for the Conservancy's Great Lakes Project. Her projects include developing a Great Lakes conservation information website (Great Lakes Information Management and Delivery System), stream connectivity decision tool, and co-leading planning and assessment work for the chapter. Mary is a graduate of Yale University where she majored in History and Studies in the Environment, and holds a M.S. from the University of Michigan's School of Natural Resources and Environment.

**Targeting Barrier Removal to Benefit Migratory Fish Species in the Great Lakes**
*Co-authors: Matthew Herbert and Eugene Yacobson, The Nature Conservancy; Thomas Neeson, University of Oklahoma; Peter McIntyre, University of Wisconsin – Madison Center; Patrick Doran; Matthew Diebel, Wisconsin Department of Natural Resources*
Fish migration into tributaries is critical for Great Lakes fish population/community structure, fisheries production, important nutrient exchanges, and other services. These migratory populations have been highly impacted by an extensive system of barriers in the region, as well as other impacts on spawning habitat. While of benefit to migratory fish to remove barriers, pressures to keep barriers in place, including control of key invasive species like Sea Lamprey, affect progress toward connectivity restoration for Great Lakes migratory fish. To date, the region has lacked a systematic method to compare the costs and benefits of barrier removal. Spatial data on migratory fish priorities is a critical to evaluate the benefits of barrier removal within the model. Recently, The Nature Conservancy compiled data on distribution and abundance for a suite of over 40 migratory species in the Great Lakes basin. We will discuss the selection of species, sources of data, and analysis to prioritize tributaries important to Great Lakes migratory fish. We are collaborating with researchers who have developed a basin-scale mathematical optimization model to prioritize barriers for repair or removal based on benefit-cost comparisons. We will also describe our progress toward incorporating beneficiary species into the optimization model.

**KLUMP, VAL J.,** *University of Wisconsin – Milwaukee, School of Freshwater Sciences*
J. Val Klump is a Professor and Associate Dean of Research in the School of Freshwater Sciences at the Great Lakes WATER Institute at the University of Wisconsin-Milwaukee. Building on 30 years of research, and as part of an interdisciplinary team of scientists, Klump and colleagues have been studying the dynamics of hypoxia in Green Bay for the last several years in an attempt to link watershed processes, climate, hydrodynamics and biogeochemistry into a comprehensive view of the controls on hypoxia and the possible solutions for improving water quality in the future.

**Green Bay hypoxia, eutrophication and climate change - an overview**

*Co-authors: Kevin Fermanich and Paul Baumgart, University of Wisconsin – Green Bay; Hector Bravo and Shelby LaBuhn, University of Wisconsin-Milwaukee; Ed Verhamme and Joseph V. DePinto, LimnoTech*

Green Bay has likely experienced hypoxia for as long as eutrophic conditions have existed in the bay, a period extending well back into the last century, but data on the extent and duration of hypoxia have only been acquired in the last few years. Accelerated nutrient loading from the Fox River watershed (~30% of the total P load to Lake Michigan), has led to persistent hyper-eutrophic conditions and excessive algal production in the southern bay for decades. Because of its morphology and restricted water mass exchange with Lake Michigan, the bay is a very efficient nutrient and sediment trap, sequestering up to 70% or more of these annual inputs in rapidly accumulating, organic rich sediments which reach organic carbon content of up to 10%. High rates of deposition of labile algal detritus fuel sediment oxygen demand sufficient to deplete bottom waters of oxygen throughout large portions of the relatively shallow southern bay during the summer stratified period. This presentation will provide an overview of the dynamics controlling hypoxia in the bay and the potential impacts of changing climate. Restoration of water quality in the area of concern and the bay at large will require significant reductions in nutrient loading approaching 40-50%. In order to develop management strategies that can improve water quality, models are being developed to assess the magnitude of nutrient reductions necessary to attenuate hypoxia under a range of current and future watershed and climate scenarios.

**Contribution of advective heat transport to stratification in Green Bay, Lake Michigan**

*Co-authors: Hector R. Bravo, Sajad A Hamidi, and James T Waples, University of Wisconsin-Milwaukee*

Summer bottom water hypoxia is a frequent water quality problem in Green Bay. The nutrient loading has been quite constant, yet the magnitude and duration of summer hypoxia is highly variable. The bay's morphology with high riverine inflow and restricted mixing at the southern end, combined with large water mass exchange with Lake Michigan at the northern end, causes changes in the hydrodynamic structure that play a key role in the set up and persistence of stratification. The onset of hypoxia is related to thermal stratification, which results from both direct meteorological forcing and from indirect meteorological forcing that drives southerly incursion of cooler bottom waters onto highly reducing organic rich sediments. The circulation pattern can stratify the water column within hours, and can set up stable stratification that persist for days to weeks during which time sediment oxygen demand rates are sufficient to deplete hypolimnetic oxygen. Previous field measurements showed two layers of flow moving through the mouth of the bay in opposite directions during the stratified season. A 3D hydrodynamic model, supported by field measurements, demonstrated the onset of stratification by the combined effect of surface heat flux and near bottom cold water transported southerly. The surface heat flux components are short-wave radiation from the sun, sensible heat flux, latent heat flux and longwave radiation, with short-wave radiation being the largest component. The net surface heat flux is positive between mid-June and September. Model and new field data showed layered flow, with near-bottom cold water transported into the bay, and near surface warmer water transported out of the bay. The hydrodynamic model was used to calculate and visualize the contribution of advective heat transport to stratification. Calculations showed that advective heat transport is as important as surface heat flux in the onset of stratification.

**KORNIS, MATTHEW S.,** *Fish Biologist/Data Analyst, U.S. Fish and Wildlife Service, Great Lakes Fish Tag and Recovery Lab*

Matt Kornis is an aquatic ecologist with nine years of experience in fisheries, including six in the Great Lakes. He has worked as a fish biologist and data analyst with the U.S. Fish and Wildlife Service since May 2014. Specifically, Matt works with the Great Lakes Mass Marking Program, a comprehensive, coordinated fish tagging and recovery program involving state, federal, tribal and provincial agencies. His current research includes analyzing coded-wire tag return data to evaluate post-release survival, movement patterns, and wild recruitment of stocked lake trout and Chinook salmon. Matt is also involved in several stable isotopes studies seeking to improve understanding of Great Lakes food webs and competition among salmonines. Matt earned a B.A. from Lawrence University, and M.S. and Ph.D. degrees from the University of Wisconsin-Madison. Prior to joining the Fish and Wildlife Service, Matt spent 3 years working as a post-doctoral scientist with the Smithsonian Environmental Research Center.

**Post-stocking survival and spatial spread of lake trout stocked in Lake Michigan**

*Co-authors: Ted Treska, Dale Hanson, Mark Holey, and Charles Bronte, U.S. Fish and Wildlife Service; Charles Madenjian, U.S. Geological Survey, Great Lakes Science Center; David Boyarski, Wisconsin Department of Natural Resources; Erik Olsen, Grand Traverse Band of Ottawa and Chippewa Indians; Kevin Donner, Little Traverse Bay Band of Odawa Indians; Barry Weldon, Little River Band of Ottawa Indians*

Lake trout (Salvelinus namaycush) was historically the dominant piscivore in the Laurentian Great Lakes, but was nearly extirpated from all but Lake Superior by the 1960s due to overfishing and predation by invasive sea lamprey (Petromyzon marinus). Rehabilitating Great Lakes lake trout to self-sustainability through an extensive stocking program has been a major priority since their collapse, with millions of yearling fish stocked annually. Here, we examine lake trout recovered from 1998-present by annual gill net assessment surveys to elucidate factors related to post-stocking survival as estimated by return rates (corrected for number of fish stocked and for sampling effort) from various coded-wire tag (CWT) lots. CWTs have been used in a fraction of stocked lake trout since the 1970s and in all lake trout since 2010 to provide information on year class, stocking location, genetic strain, hatchery of origin, and size and condition of fish at stocking. Each of these factors is a potential predictor of post-stocking survival. Early findings suggest stocking location played the largest role in post-stocking survival, as CWT fish are stocked in several refuges that vary in mortality associated with sea lamprey and commercial fishing. Recoveries were greatest for fish stocked in at Julian's reef, which is of interest in context of mounting evidence of wild lake trout recruitment in Southern Lake Michigan. For fish stocked at locations with relatively low mortality, recoveries were positively related to length at stocking, and were highest from genetic strains of remnant Lake Michigan populations. Finally, lake trout stocked at offshore areas, especially the Southern Refuge and Julian's Reef, are commonly recaptured nearshore, where they are accessible to the recreational fishery and have increased length-at-age relative to offshore-recovered fish. Our results will enhance understanding of how stocking practices affect the lake trout rehabilitation effort in Lake Michigan fisheries.

**KOWALZEK-ADRIANS, ANGELA,** *Natural Resources Planner, Bay-Lake Regional Planning Commission*

Angela Kowalzek-Adrians is a Natural Resources Planner for Bay-Lake Regional Planning Commission (RPC) in Green Bay, Wisconsin. She is responsible for management of the environmental, coastal, and hazard mitigation programs at Bay-Lake RPC. For the past 14 years, Ms. Kowalzek-Adrians has worked with local governments, and state and federal agencies to promote sustainable planning and smart growth initiatives in northeast Wisconsin. Ms. Kowalzek-Adrians holds a Master's degree in Environmental Science and Policy with an emphasis in Environmental Planning from the University of Wisconsin - Green Bay.

**A Coastal City with No Beach: Restoring an Abandoned Beach in Green Bay, Wisconsin**

A 3-year project was initiated in 2012 to explore the potential to restore swimming to Bay Beach in Green Bay, Wisconsin, an abandoned beach that has been closed to swimming for nearly 75 years due to pollution. The beach is located along Lake Michigan within the Lower Green Bay and Fox River Area of Concern (AOC) in northeast Wisconsin. Even without a beach, Bay Beach is a regional tourist attraction as a municipal amusement park offering nearly 20 carnival rides with no admission charge and affordable 25-cent ride tickets. Bay Beach's history dates back to 1892 when it was established as an amenity-rich private beach resort. Swimming was incredibly popular at Bay Beach in the early 1900's. But it began experiencing frequent closings in the 1930's due to pollution, and by 1943, it was forced to permanently close to swimming. Surveys conducted in 1988 revealed that restoring swimming to Bay Beach was a major change the public hoped would result from AOC restoration work. Many in the community have desired restoring Bay Beach for a long time. But an evaluation of what that would entail had not been undertaken before this project. U.S. Environmental Protection Agency funding was secured to develop a restoration action plan for the beach based on water quality monitoring, historic data, and site assessments. Project objectives included determining the health and safety of the beach for swimming, evaluating restoration potential, developing mitigation actions, and garnering community support for restoration. To this end, samples were collected to identify E. coli and microcystin levels, and data was gathered on PCB levels near the beach. Recommendations on best management practices, and a redesign concept plan were developed.

**KREIS JR., RUSSELL G. ,** *Station Director and Branch Chief, U.S. Environmental Protection Agency, Office of Research and Development*

Russ is with the U.S. Environmental Protection Agency's (U.S. EPA's) Office of Research and Development (ORD) and has worked for the U.S. EPA for 29 years. For the last 20 years he has served as Station Director and Branch Chief of the Large Lakes Research Station at Grosse Ile, Michigan. Russ received both his Bachelors and Master's degrees from Eastern Michigan University and his Ph.D. from the University of Michigan. Russ has worked on the Great Lakes for over 40 years and has authored or co-authored over 70 publications and reports. He has worked on the Straits of Mackinac, Fox River/Green Bay Mass Balance, and the Lake Michigan Mass Balance Study in Lake Michigan. He is a past Secretary of the International Association for Great Lakes Research, Co-Director of the Lake Erie Millennium Network, and has received U.S. EPA Bronze Medals for his Great Lakes research.

**Lake Michigan Lake Trout PCB Model Forecast Post Audit**

*Co-authors: Xiaomi Zhang, Trinity Engineering Associates; Elizabeth W. Murphy, USEPA-GLNPO; Kenneth R. Rygwelski, USEPA-ORD; Glenn Warren, USEPA-GLNPO; Paul J. Horvatin, USEPA-GLNPO; Wilson Melendez, Computer Sciences Corp*

Scenario forecasts for total PCBs in Lake Michigan (LM) lake trout were conducted using the linked LM2-Toxics and LM Food Chain models, supported by a suite of additional LM models. Efforts were conducted under the Lake Michigan Mass Balance Study and the post audit represents an approximate 20-year period since the conclusion of the study. Forecasts of 5 to 6-year old lake trout indicate that total PCB concentrations will continue to decrease and the Sports Fish Advisory Task Force's goal for unrestricted consumption could be achieved in coming years, during the mid-2030s. Compared to PCB data for lake trout from the Great Lakes Fish Monitoring Program, the model forecasts and data exhibit good agreement, suggest that the model forecasts are reasonable, and that concentrations should continue to decline. Results are consistent with long-term decreases in other media and together indicate a considerable weight of evidence for continued decreases and improvements in the ecosystem from various actions. Variability and uncertainty are anticipated, subject to environmental changes, and we will present some information on the food web that may accelerate or exacerbate the anticipated future. This abstract does not necessarily reflect U.S. EPA policy.

**LAFRANCOIS, BRENDA MORASKA,** *Midwest Region Aquatic Biologist, National Park Service*

Brenda has served as the Midwest Regional aquatic ecologist for the National Park Service since 2002, providing technical support to nine parks in the upper Great Lakes area. Brenda's work addresses a variety of water resource issues, ranging from water quality and contaminants to invasive species and ecosystem change. She loves tiny rock pools and big lakes equally, but has been preoccupied with Lake Michigan since 2006 and the Great Lakes Restoration Initiative since 2010. Brenda lives with her husband and daughter in northern Wisconsin, where she enjoys skiing over lunch break and taking dips in another of the world's greatest lakes.

**A decade of nearshore ecosystem change: observations from Sleeping Bear Dunes**

*Co-authors: Harvey Bootsma band Emily Tyner, University of Wisconsin (UW)-Milwaukee School of Freshwater Science; Sue Jennings, Sleeping Bear Dunes National Lakeshore; Dan Ray, Sleeping Bear Dunes National Lakeshore; Jay Glase, National Park Service, Water Resources Division; Chris Otto, Sleeping Bear Dunes National Lakeshore*

The past decade has brought unprecedented ecological changes to Lake Michigan, with disruptive species invasions, booming benthic algal growth, shifts in fishery structure, and marked fluctuations in climate and lake levels. Here we present observations and perspectives from a decade of intensive nearshore research and monitoring at Sleeping Bear Dunes National Lakeshore. Major changes from 2006-2015 include the expansion of quagga mussels throughout the park's Lake Michigan waters; invasion by the round goby with resulting changes in nearshore food webs and dreissenid size structure; development and discovery of anoxic nearshore depositional areas; the resurgence (and potential abatement) of avian botulism outbreaks; and large climatic and hydrologic fluctuations with implications for many aspects of nearshore and coastal ecology. Much of our work has emphasized continuous measurements and/or direct observation through the use of remotely-operated vehicle and multi-beam sonar technologies, SCUBA, and time lapse photographic imagery. Collectively this work has yielded important long term data on nearshore conditions and has generated unique visual perspectives on nearshore ecosystems during a period of significant ecological upheaval. Local citizens have made invaluable contributions to botulism beach monitoring at Sleeping Bear Dunes, and are poised to help sustain this nearshore monitoring effort into the future. Sleeping Bear Dunes has become an important 'natural laboratory' for Lake Michigan nearshore monitoring and research.

**LaPORTE, ELIZABETH A.,** *Science Outreach Manager, University of Michigan Graham (U-M) Sustainability Institute*

Elizabeth LaPorte is the Science Outreach Manager for the U-M Graham Sustainability Institute and has more than 30 years of experience in science communications and public outreach. She works with local, state and national organizations to promote sustainability. Key efforts include translating science for targeted stakeholders about fluctuating water levels, water quality, coastal resiliency and climate change. A major initiative is to promote the benefits of collaborative and interdisciplinary research teams. Also related to coastal resiliency, LaPorte is involved in leading coastal water safety and Clean Marina water quality efforts. LaPorte has a Bachelor's degree in communication from U-M, a Master's degree in communication, and a Master's Certification in educational media and technology from Eastern Michigan University.

- U-M Graham Institute, www.graham.umich.edu
- Water Safety Campaign, www.currentsmart.org
- Michigan Clean Marina Program, www.michigancleanmarina.org

**Why Do Lake Levels Matter?**

*Co-author: John Callewaert, University of Michigan – Graham Sustainability Institute*

Great Lakes water levels rise due to precipitation, runoff, and flow from rivers and streams. Water levels decrease due to evaporation, diversion, and the natural flow of water through the system. Changes vary be seasons, and by lake. With more than 3,500 miles of Great Lakes shoreline, lake levels have a huge impact on Great Lakes coastal communities and economies. When levels fluctuate much above or below the long-term average, the impacts can be significant. Lake levels affect coastal properties and infrastructure, as well as shipping, recreation, and manufacturing. They also affect plant and wildlife habitat. In 2014, more than 1,800 Great Lakes property owners, managers, and others participated in a survey focused on key concerns of both high and low water levels. Among the total participants 1,307 perceived that there was negative impact of high water levels, 662 perceived that there was a negative impact of low levels, and 442 indicated there was a negative impact of both high and low levels. Respondents rated ice cover, precipitation and evaporation as the top three factors contributing to water level change. Also, respondents rated their perception of how humans have an impact on water level changes, with diversions, structural controls and dredging the top three factors mentioned. The Graham Institute is supporting seven teams of U.S. and Canadian researchers for six-month planning grants. The planning grants will examine potential adaptive strategies and identify appropriate localities and partners willing to collaborate with project leaders. This is the first phase of efforts to identify potential regulatory and non-regulatory options that may be considered in for Lakes Michigan, Huron and Erie, including the Huron-to-Erie Corridor. Interdisciplinary research teams are evaluating environmental, social, political, and economic issues to assist people, businesses, and governments adapt to fluctuating water levels in the future.

**Be Current Smart: Targeting Parents and Teens to Improve Water Safety**

*Co-authors and presenters: Gene Clark, Wisconsin Sea Grant Institute; Brent Schleck, Minnesota Sea Grant*

Launched in May 2015, the Be Current Smart water safety campaign (CurrentSmart.org) is a collaboration of the National Oceanic and Atmospheric Administration's (NOAA) Sea Grant and Coastal Zone Management programs. The campaign is focused on information about new water safety and rescue equipment, primarily targeting young men and parents. This regional campaign focuses on 1) outreach materials like video animations, news releases, and social media resources; and 2) Water safety and rescue equipment (e.g., life jackets, throw rings, and rescue boards) deployed at Great Lakes beaches. The project team has distributed nearly 2000 pieces of equipment to communities and beaches in Minnesota, Wisconsin, Michigan, Indiana, and Illinois. Many of the beaches receiving equipment are not guarded; therefore, there is no safety equipment and rescues are often dependent on First Responder response times. Having equipment at these beaches could turn a potential drowning into a successful rescue. Additionally, the CurrentSmart.org website hosts outreach materials informed by social science research conducted through Michigan Department of Environmental Quality, Office of the Great Lakes-Coastal Management Program and the NOAA Coastal Storms Program.

Attendees will learn about current and future water safety efforts conducted. Also presented will be lessons learned from project leaders about the first phase of implementation, such as best practices for engaging local water safety working groups in six states; safety and rescue equipment distribution and maintenance; the initial analysis of social media strategies for the Be Current Smart campaign; and ideas for sustaining a regional water safety network, including Sea Grant, university experts, first responders, non-governmental organizations, as well as state, local and federal government agencies. The project is led by Illinois-Indiana, Michigan, and Wisconsin Sea Grant programs, in partnership with five Coastal Management programs, and Minnesota and Ohio Sea Grant programs. The NOAA Coastal Storms Program is supporting this project.

**LEDERLE, PAT,** *Planning and Adaptation Section Supervisor, Wildlife Division, Michigan Department of Natural Resources*

Pat Lederle has been a Wildlife Planning Supervisor (4 years), Research Supervisor (8 years) with Michigan Department of Natural Resources (MDNR), Wildlife Division. He served as Adjunct Associate Professor with the Department of Fisheries and Wildlife, Michigan State University, and is Past-President of North Central Section of the Wildlife Society. A certified Wildlife Biologist with a BS and PhD from Michigan State University and a MS from the University of Minnesota, Pat is responsible for managing collaborative statewide wildlife planning program on both game and non-game species. He is the co-leader of the Wildlife Division's strategic planning efforts. Previously, he served eight years as the Research Supervisor and three years as the State Endangered Species Coordinator. Prior to working for the MDNR, Pat was involved with research on ecological impacts from Department of Energy's Yucca Mountain Project, a proposed nuclear waste repository. He also spent more than ten years in Michigan's Upper Peninsula running a comprehensive research project evaluating the impacts of extremely low frequency electromagnetic fields on birds and mammals.

**Collaborative Approach for Management of State Lands on Northern Lake Michigan Islands**

*Co-authors: Keith Kintigh, Jennifer Kleitch, Jennifer Olson, and Brian Mastenbrook, MDNR, Wildlife Division*

The Wildlife Division of the MDNR administers approximately 26,000 acres of land in the Beaver Island and Fox Island archipelagos. Most of this land came into state ownership in the past 75 years, and in 1967 these properties were designated as the Beaver Island Wildlife Research Area. Management initially focused on game species introductions and research on the impacts of hunting. In recent decades, active management has decreased and there was an increased recognition of the unique qualities of island properties. Because of recent community-based planning efforts on Beaver Island and development of the MDNR's Managed Public Land Strategy, the Division began to develop a management plan for state-owned land in the archipelagos using a collaborative approach. This talk will provide an introduction to these unique properties and an overview of the collaborative management planning process. Our planning efforts were guided by the Department's emphasis on resource conservation, recreational opportunities, and natural-resource based economies, and the obvious links between the unique natural resources on the islands and the interests of island residents and visitors. Discussions and meetings with county and township officials, tribal governments, Central Michigan University, interested groups, and local residents provided substantive input leading to collaborative development of management goals and objectives focused on required partnerships, protection of ecological and cultural resources, and promotion of sustainable island-appropriate recreational and economic opportunities. Because of the unique qualities of island properties and logistical challenges posed by access, the most important factor in successful implementation of this plan is the strength of the partnerships developed and maintained by the groups and individuals involved.

**Lenters, John D., PhD,** *Senior Scientist, LimnoTech*

A recognized expert in observation networks, lakes, watersheds, and climate science, Dr. Lenters has been involved in a variety of research projects related to the impacts of climate on lakes, particularly in Alaska, Nebraska, and the Great Lakes region. He has been leading a global initiative to study the long-term warming of lakes worldwide, and s also working with a number of institutions to establish a coordinated observation network for Great Lakes evaporation. Dr. Lenters is a member of the International Association for Great Lakes Research, American Geophysical Union, American Meteorological Society, and the Global Lake Ecological Observatory Network. His work has been featured in the *Journal of Great Lakes Research*, *Water Resources Research*, and *Journal of Climate*, as well as popular literature such as *Smithsonian Magazine* and National Geographic's "*Water Currents*." Before joining LimnoTech, Dr. Lenters was an associate professor in the School of Natural Resources at the University of Nebraska-Lincoln (UNL). He has also worked at Lake Superior State University, the University of Wisconsin-Madison, and Cornell University, where he received his Ph.D. in atmospheric science.

**Great Lakes Evaporation -** *Abstract Pending*

**LEWANDOWSKI, TONYA,** *Senior Engineer, Environmental Consulting & Technology, Inc. (ECT)*

Tonya Lewandowski, is a Senior Engineer with more than ten years in construction and consulting engineering experience out of ECT's Traverse City office. Ms. Lewandowski graduated from Michigan Technological University in 1999 with a Bachelor of Science in Civil Engineering, minor in Environmental Engineering. Ms. Lewandowski is passionate about her work in natural resources, where her expertise is low impact development (LID) stormwater management, site layout, development, and design. Her engineering background is strong in design, specification preparation, and construction oversight capabilities, but project management and client interaction remain her favorite tasks. Other areas of expertise include: Stormwater Management, LID Stormwater Management, Construction Engineering, Construction Document Preparation, Construction Oversight, Retaining Wall Design, Site Layout, Site Development and Design, Water Main and Sewer Engineering, Wastewater Treatment Plant Design Engineering, and Permit Application Preparation.

**Sherman Park Beach Restoration: BMP Design, Partnerships, and Planning for the Future**

*Co-authors: Christine Daly, Chippewa County Health Department; Annette DeMaria, Project Manager, ECT*

In 2014, Sherman Park Beach was restored to address water quality and erosion issues. Located between Lakes Superior and Huron along the St. Mary's River AOC, Sherman Park Beach has experienced periodic closures due to elevated levels of E. coli from stormwater runoff. Conditions at this site included: parking lot runoff flows on to the beach via newly constructed sidewalks, trapped stormwater runoff from the beach between two jetties, a low profile beach resulting in saturated sand more likely to harbor bacteria (as compared to drier sand), and poorly maintained and degraded dunes. Restoration efforts included the installation of four rain gardens to filter stormwater, removal of a jetty to improve water circulation, and construction of a sand dune to deter gulls from loafing at the beach and improve runoff water quality. This project was funded by a Great Lakes Restoration Initiative grant awarded to the Michigan Department of Environmental Quality and Chippewa County Health Department with matching effort provided by the City of Sault Ste. Marie. Complete restoration would not have been possible without in-kind efforts by project partners including: Health Department (Owner), City, Contractor, Engineer and numerous community volunteer groups.

During the design phase, a second beach site was considered for restoration. However, site conditions limited the number of available best management practices that would be effective in improving water quality, especially considering the effects of climate change and water levels within the Great Lakes. Therefore, the site was dropped from the scope of work.

This presentation will discuss design considerations, speed bumps that were encountered, and lessons learned which will be applicable to others undertaking beach restoration projects. We will also discuss how preparing a beach nourishment and maintenance plan, and a community outreach volunteer program, will ensure the improvements and healthy beach conditions are around for years to come.

**LUPI, FRANK,** *Professor of Agricultural, Food, & Resource Economics and Fisheries & Wildlife, Michigan State University*

Frank Lupi is a professor at Michigan State University with joint appointments in Agricultural, Food, & Resource Economics and Fisheries & Wildlife. He is an environmental and natural resource economist whose research includes demand and valuation of Great Lakes fisheries and beaches.

**Valuing the impact of harmful algal blooms on Lake Erie beaches**

*Co-author: Leah H. Palm-Forster, Applied Economics and Statistics, University of Delaware*

Fueled by agricultural phosphorus runoff, harmful algal blooms (HABs) in Lake Erie have contaminated drinking water, damaged ecosystem health, and affected valuable fisheries, lake front property, and recreation sites. An influx of funds supporting policies reducing nutrient runoff has spurred demand for timely information about the potential value of these programs. Here, we estimate how the recreational value of Lake Erie beaches is affected by harmful algal blooms. We also show how beach values can be estimated when limited time and funding inhibit studies involving primary data collection.

We use a valuation approach called benefit transfer that involves using previous research on Great Lakes beach values to estimate damages caused by beach closures in Lake Erie. We transfer beach values and a model from an original study that valued Great Lakes beaches in Michigan (Chen, 2013). That study provides a model that accounts for individual decisions to take a beach trip and the choice of which beach site to visit. The ability of the model to predict trips is essential for our study

because beach visits are not reported for many Lake Erie beaches. We use census data for Ohio, Michigan, and Indiana to update the model and estimate how many single-day trips are taken to each beach when HABs are not present.

We simulate beach closures on 67 Lake Erie beaches in Ohio and Michigan and then calculate how much recreational value is lost because of the closure. Results suggest that, on average, visitors are willing to pay $8.51 per person to avoid losing a day trip to a given beach. A day-long closure of a single beach results in average losses of $10,200. Losses increase non-linearly as more beaches are affected. Closing down six beaches in Western Lake Erie results in daily losses of $139,000.

Chen, M. 2013. Valuation of public Great Lakes beaches in Michigan. Ph.D. East Lansing: Michigan State University. Available at: http://web2.msue.msu.edu/afreTheses/fulltext/Min%20Chen%20Dissertation.pdf [Accessed 5/31/2015].

**MAGUIRE, ANDREA,** *Program Coordinator, Great Lakes Observing System*

Andrea Maguire is a program coordinator at the Great Lakes Observing System (GLOS). With a background in ecology and policy, her work is focused on making science and data accessible to decision-makers in the Great Lakes. Andrea's experience includes working as a fellow at the U.S. Environmental Protection Agency and the US Global Change Research Program. Her projects included climate change impacts research, indicators, and scientific and economic assessments. Previously, she did ecological research at field stations across Michigan, Florida and Costa Rica. She has a MS in Ecology from Michigan State University, and a BS in Biology and in the Program in the Environment from the University of Michigan.

**The Great Lakes Observing System: Serving up data to support beach management in the Great Lakes**

*Co-authors: Kellie Paige, GLOS; Tad Slawecki, LimnoTech*

The Great Lakes Observing System (GLOS) is a bi-national nonprofit organization established to advance the coordination of the extensive network of people, processes and technology that work together to maximize access to critical, real-time and historical data and information in the region. GLOS takes a user-oriented approach to its work, engaging stakeholders, managers, researchers, policy makers, and educators to ensure that the services it provides meet the specific needs of these data user groups.

A key objective for GLOS is to deliver data in a variety of ways, with the goal of developing easy-to-access data and decision support products. GLOS-supported products have applications in guiding spill response, aiding search and rescue efforts, recreation, and more. Examples of GLOS-supported products and services relevant to beach management include:

- Great Lakes Coastal Forecasting System (GLCFS) Point Query tool – providing quick access to National Oceanic and Atmospheric Administration GLCFS input data and model output for a given location and time period.
- Huron to Erie Connecting Waterways Forecasting System (HECWFS) – providing nowcasts and forecasts for currents and water level.
- myBeachCast – The Great Lakes Commission's website and mobile app that deliver critical information about beach advisories and related human health information.
- Virtual Beach/ USGS EnDDat – a collaborative effort between EPA, USGS, Wisconsin Sea Grant, and WI DNR, GLOS data services enable the development and implementation of daily water-quality "nowcasts" at coastal beaches throughout the Great Lakes.
- GLOS Data Portal – our web mapping portal that aggregates, displays and provides download access to near-real-time and archived observations and to model forecasts.
- Great Lakes Nearshore Buoy Network – providing real-time physical, bio-chemical, and remote sensing data around Lake Michigan and the Great Lakes.

As GLOS continues to build partnerships across the Great Lakes region, we seek ideas and feedback from stakeholders on ways that GLOS can better support management in the region.

**McCauley, Dennis,** *President, Great Lakes Environmental Center, Inc.*

Dennis McCauley is the President and a Principal Research Scientist at Great Lakes Environmental Center, Inc. (GLEC) in Traverse City, Michigan. At GLEC, Dennis manages and collaborates with professional and technical staff to plan and conduct complex field and laboratory studies which assess the impact of habitat changes, complex effluents, contaminated sediment, storm water, and single chemicals on aquatic biota, and participates as a principal investigator and/or technical advisor in

multiple field and laboratory studies. Since 2004, Dennis has lead every National Aquatic Resource Assessment work assignment and task order for GLEC, including the 2010 and 2015 National Coastal Condition Assessments. Dennis has both a Bachelor and Masters degrees from the University of Wisconsin. Dennis has been employed by GLEC for the past 26+ years and previously worked for the Wisconsin Department of Natural Resources and the Center for Lake Superior Environmental Studies at the University of Wisconsin-Superior.

**2015 National Coastal Condition Assessment Update (Lake Michigan)**
*Abstract Pending*

**McCOMBS, JOHN,** *Senior Remote Sensing Specialist, The Baldwin Group at the National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management*
Mr. McCombs has been the contract lead for the NOAA Coastal Change Analysis Program for the past 12 years. In that time he has overseen the completion of four dates (1996, 2001, 2006, 2010) of nationwide coastal land cover and change, along with additional dates in other geographies. Prior to NOAA, Mr. McCombs has performed land cover mapping for the Mississippi and Virginia Gap Analysis Programs, and has performed research using lidar for forest inventories.

**Coastal Land Cover Change and Analysis in the Great Lakes**
*Co-authors: Nate Herold, NOAA Office for Coastal Management*
Land use and land cover play a significant role as drivers of environmental change. Information on the location and what land covers are changing is essential to improving our understanding of past management practices, and in effectively responding to those environmental and human induced changes. NOAA's Coastal Change Analysis Program (C-CAP) produces nationally standardized land cover and land change for the coastal regions of the U.S. These products provide inventories of coastal intertidal areas, wetlands, and adjacent uplands (using documented, repeatable procedures) with the goal of monitoring these habitats every five years. Information on what land covers are changing and where those changes are occurring is essential to improving our understanding of past management practices, and in effectively responding to those environmental and human induced changes now and in the future. Within the Great Lakes region, six dates of C-CAP land cover exist from 1975 to 2010. Funds from the Great Lakes Restoration Initiative has been instrumental in the completion of these data and are a primary driver behind the 2015 update (soon be underway) which will allow for a 40-year examination of land cover and land cover change. This presentation will summarize C-CAP methods and accuracy, discuss the availability of C-CAP data and how that data can be accessed via NOAA's Digital Coast, and highlights several tools that make use of these data in a user-friendly format.

**MEADOWS, GUY A.,** *Director, Great Lakes Research Center, Michigan Technical University*
Upon graduation from Purdue University in 1977, Guy Meadows joined the faculty of the University of Michigan, College of Engineering, where he served as Professor of Physical Oceanography for 35 years within the departments of Atmospheric, Oceanic and Space Sciences and Naval Architecture and Marine Engineering. During his tenure, he served the College and University as Director of the Ocean Engineering Laboratory, Director of the Cooperative Institute for Limnology and Ecosystems Research (National Oceanic and Atmospheric Administration [NOAA], Joint Institute), Director of the Marine Hydrodynamics Laboratories and founding Academic Director of the M-STEM Academy. He joined Michigan Tech in June of 2012, to help establish the new Great Lakes Research Center as its founding director. His primary goal, to blend scientific understanding and technological advancements into environmentally sound engineering solutions for the marine environment, has led to a distinguished career of teaching, research and service.

**Dangerous Great Lakes Nearshore Waves and Currents: Field and Satellite Observations**
*Co-author: Amanda Grimm, Michigan Technological University – Michigan Tech Research Institute*
Between 2002 and 2013, there were a total of 434 reported incidents (drowning or rescues of swimmers) related to dangerous nearshore currents (DNCs) in the Great Lakes, with an average of approximately 12 drowning deaths per year (NOAA 2014). An analysis of reported rip current fatalities from 1994-2007 found Michigan to have the fourth deadliest coastline in the U.S., led only by Florida, California, and North Carolina. Within the Great Lakes Basin, the majority of current-

related incidents have occurred in Lake Michigan. Improved prediction, mapping, and modeling of DNCs are critical to saving lives. Additionally, monitoring and sustaining beach safety is critical to many local coastline economies dependent on tourism and local beach users. Efforts to understand the mechanisms that produce dangerous nearshore conditions in the Great Lakes and develop reliable forecasting methods to educate the public are dramatically lagging the ocean coasts. Although the Great Lakes are similar to the ocean in many ways, the Great Lakes experience variable water levels (on many time scales) that affect the location and movement of near shore sandbars, in turn affecting the location and formation of rip current channels. Water level measurements coincident with the rip current related drowning of four men at Nickel Plate Beach on Lake Erie in July 2002 and seven people at Warren Dunes State Park on Lake Michigan in July 2003 show dramatic evidence of seiching in both cases (Guenther 2003, Meadows et al. 2011). These conditions must be considered for the formulation of a comprehensive rip current forecasting method for the Great Lakes. Results of three field data collection efforts along the Lake Michigan coastline, and a massive, high-resolution, satellite based, remote sensing data collection will be discussed. These combined efforts were funded by Michigan Department of Environmental Quality to provide enhanced, data driven, guidance to beach and nearshore managers.

**MEDNICK, ADAM,** *Wisconsin Sea Grant Institute*
Adam Mednick is a post-doctoral fellow with the University of Wisconsin Sea Grant Institute and a board member of the Great Lakes Beach Association. Adam's cooperative extension work on behalf of both the developers and users of the "Virtual Beach" software system, and other decision tools, provides support to the Wisconsin Department of Natural Resources and other state, local, and federal agencies, academic institutions, and NGO's around the Great Lakes.

**Implementing Predictive Models: Practical Advice and New Tools**
Public agencies charged with managing beach water quality are typically faced with a narrow set of imperfect options. Whether the decision is to post an advisory on a given day, or how to mitigate chronic pollution at a particular site, managers and decision-makers at all levels have limited time, resources, and/or information with which to work. Beach-related R&D (e.g., source-tracking, sanitary surveys, predictive models, and visitor surveys) can inform management decisions; however, they don't always improve (or even influence) them. This presentation will provide managers and researchers with some of the basics of 'decision science' and the field of cooperative extension, using the results of a 2013 survey to illustrate key points. The aim is to get beach managers and beach scientists thinking (and hopefully talking) about how best to bridge the gap between research and the 'real-world' – in the hopes of improving both.

**MELCHIOR, MARTY,** *Regional Director, Inter-Fluve*
Marty Melchior is the Eastern Region Director for Inter-Fluve, a river restoration design firm. Marty has over 20 years of experience in the assessment and design of river restoration projects, including natural channel design, dam removal, and habitat restoration. He lives near Madison, Wisconsin.

**Advances in Design and Restoration Techniques Part 2**
**Boardman River Reborn - Community Lessons in Dam Removal**

**MIFSUD, DAVID,** *Herpetologist, Herpetological Resource and Management, LLC*
David A. Mifsud is a Certified Wildlife Biologist, Certified Professional Ecologist, and a Professional Wetland Scientist. He has been working for twenty years in wildlife biology, wetland ecology, and habitat conservation and management with expertise in Michigan amphibians and reptiles. Mifsud is the Michigan Herpetological Atlas Administrator, Co-Chair of the State of Michigan Amphibian and Reptile Technical Advisory Board, and serves as an expert on Great Lakes Turtles for the International Union for Conservation of Nature (IUCN) Tortoise and Freshwater Turtle Specialist Group. In 2014, he completed the Michigan Amphibian & Reptile Best Management Practices Manual and is currently working on a revision as co-author to the Amphibians and Reptiles of the Great Lakes Region due out in 2016.

**Amphibians and Reptiles of the Lake Michigan Basin: Status and Conservation**
Amphibians and reptiles are recognized as key biological indicators. Their presence, density, and distribution are important in assessing the health and quality of a landscape. The Lake Michigan basin has the greatest diversity of amphibians and reptiles in the state. This presentation will discuss what species occur in the basin, reasons for the richness present in this area, threats these species face, and ways to protect and improve conditions for amphibians and reptiles. The presentation will also focus on ways participants can get involved in the MI Herp Atlas program and help document observation of these species throughout Michigan.

**Michigan's Emerald Isle: Amphibians and Reptiles of the Beaver Island Archipelago**
The Beaver Island Archipelago is one of Michigan's lesser known ecological gems. This region has a rich geological, cultural, and ecological history. Situated in Lake Michigan these islands have evolved a unique assemblage of wildlife adapted to northern Michigan and island life. Until recently, work conducted on the archipelago targeting amphibians and reptiles was focused around the Central Michigan University (CMU) Biological Station. In 2013, Herpetological Resource and Management (HRM) was contracted by Conservation Resource Alliance (CRA) to establish baseline herpetological diversity within the Archipelago to monitor restoration activities associated with invasive species removal and identify opportunities for potential future restoration. This herpetological work built on the efforts of CMU staff and students, and others who have conducted research on the islands. With the help of the Beaver Island Association and CRA staff, HRM has been able to document the spatial distribution and habitat use of herpetofauna on the islands. In addition, this work has resulted in the discovery of new species records for multiple islands, and an overall better understanding of the unique nature of this region. Density and overall richness of amphibians and reptiles in the Archipelago provides a critical reference point for comparison of Michigan's amphibians and reptiles and what much of the mainland once contained 50-75 years ago. The diversity and abundance of these biological indicators is a testament to the unique and high quality landscapes of this region and the importance of protecting the area.

**MOLNAR, MIKE,** *Director, Lake Michigan Coastal Program, Indiana Department of Natural Resources*
Mike Molnar is the program manager of the Indiana Lake Michigan Coastal Program, and has served in that capacity for twelve years. He oversees the day to day functions of the Coastal Program and has served as manager on multiple program projects. Past projects include public access needs assessment, coastal and estuarine land conservation plan, and underwater archaeological resource plan. Born and raised along the shores of Lake Erie, Mike learned first-hand the environmental impacts of pollution on the Great Lakes and how combined efforts can result in success. He is a graduate of Miami University of Oxford, Ohio and Indiana University, Bloomington. He holds a bachelor's degree in secondary education - biological science and a master's degree in public administration from the School of Public and Environmental Affairs.

**Building a Regional Partnership to Address Septic System Impacts to Lake Michigan**
*Co-author and presenter: David Ortel, Indiana State Department of Health; Co-authors: Doreen Carey, Indiana Department of Natural Resources Lake Michigan Coastal Program, Natalie Johnson, Northwest Indiana Urban Waters Partnership, and Joe Exl, Northwest Indiana Regional Planning Commission*
Although failing septic systems have long been identified as a potential contributor to water quality impairments in NW Indiana, there is limited public awareness of the problem and the associated health, recreation, and economic impacts. All Indiana Lake Michigan tributaries are impacted by E.coli and although the contribution from failing septic systems is not well-documented, many existing systems are decades old and a large percentage of soils in the Lake Michigan watershed are identified as unsuitable for septic systems.

Since 2013, the Indiana Lake Michigan Coastal Nonpoint Pollution Control Program has facilitated the Septic System Coordination Work Group (SSCWG). The group meets bi-monthly to addresses the issue of septic system failures in the Coastal Region, the potential impacts on health and water quality, and what can be done to improve the situation. The SSCWG includes state and local Health Departments, local, state and federal environmental agencies, NGOs, and local municipal and community representatives. The group partners presently participate in the annual U.S. Environmental Protection Agency SepticSmart Week and widely distribute SepticSmart educational information that includes septic system operation and maintenance tips for the homeowner. Group member Urban Waters Federal Partnership is conducting Septic

System focus groups throughout the region designed to determine septic system user knowledge of proper operation and maintenance. LaPorte County Health Department has adopted a Septic System Operation and Inspection Permit that is being phased in to address all septic systems in the county. This ordinance provides a model program for inspection and maintenance that will begin to address the lack of data regarding the potential health and water quality impacts of failed septic systems in the Lake Michigan watershed.

The session will review the work and accomplishments of the SSCWG and will be led by the Indiana Lake Michigan Coastal Program Special Projects Coordinator with presentations by key SSCWG partners.

**MOTT, JOANNE,** *Professor of Biology and Chair of Life Sciences Department, Texas A&M University – Corpus Christi*

**Six Key Steps for Developing and Using Predictive Tools at Your Beach**

*Co-author and presenter: Samantha Fontenelle, U.S. EPA*

To reduce exposure to waterborne pathogens at bathing beaches, beach managers need tools that can provide a quick, reliable indication of water quality conditions. The U.S. EPA encourages the use of predictive tools to make timely beach notification decisions and to deliver same-day notifications. To help states and tribes with developing and implementing predictive tools at the beaches, the U.S. EPA developed a simple "How To" Guide based on input from seven beach managers who have successfully implemented a predictive model at their beaches. The beach managers were interviewed to understand the process that each used in developing his/her model. The draft guidance was pilot tested by the Texas Beach Watch Program to assess the utility of the guidance. While predictive tools have been shown to work well at some beaches, the development and implementation of predictive tools for use at coastal beaches remains a challenge for most beach programs.

**MURPHY, ELIZABETH,** *Great Lakes Fish Monitoring and Surveillance Program Manager, U.S. Environmental Protection Agency, Great Lakes National Program Office*

Elizabeth (Beth) Murphy is the program manager for the Great Lakes Fish Monitoring and Surveillance Program (GLFMSP) in the U.S. Environmental Protection Agency's (U.S. EPA's) Great Lakes National Program Office. As program manager for a 30 year + program, Beth is responsible for monitoring and surveillance of historical and emerging contaminants in Great Lakes fish over time and determining the presence of new chemicals in fish tissue. She works very closely with the Great Lakes Consortium for Fish Consumption Advisories, Lakewide Action and Management Plans, Partner Agencies and Programs, and the Environment Canada National Fish Contaminant Monitoring and Surveillance Program to ensure that high quality data is used in decision making and reporting. Beth received her B.S. in environmental science from North Carolina State University and her M.P.H. in environmental public health from the University of Illinois at Chicago.

**Current (2008-12) distribution and body burden of monitored contaminants in Lake Trout and Walleye in the Great Lakes**

*Co-author: Daryl McGoldrick, Environment Canada*

Formal biomonitoring programs for chemicals of concern in fish have been operated by the governments of Canada and the United States in the Great Lakes since the 1970's. In the beginning, monitoring was focused on the so-called "dirty dozen" POPs listed on the Stockholm convention and mercury. These chemicals are well known in the public sphere and are the subject of many scientific publications based in the Great Lakes Basin. In the last decade, initiatives in both Canada under the Chemicals Management Plan (CMP) and the Great Lakes Restoration Initiative (GLRI) in the United States have allowed an expansion of the list of chemicals being monitored to include additional contaminants which have emerged or are of emerging concern in terms of potential harmful impacts to the environment. Examples of these compounds include polybrominated diphenylethers (PBDEs), perfluorinated compounds (PFCs), and many other chemicals used in a variety of consumer goods and personal care products. In this review, we have summarized all data contained in the fish contaminant databases of Environment Canada and the U.S. EPA for chemicals measured from 2008 to 2012 from each of the five Great Lakes to provide an integrated picture of the current status of contaminant burden of upper trophic level fish.

**Shifts in Age of Great Lakes Lake Trout; an interlaboratory comparison**

*Co-authors: Wellenkamp. W and He, J., MDNR; Landon, M.E. , CSC; Holsen, T.M., Crimmins, B.S., and Hopke, P.K. - Clarkson University; Pagano, J.J., SUNY Oswego; Milligan, M.S., SUNY Fredonia; Downey, P., Aquatec Biological Sciences.*

The Great Lakes Fish Monitoring and Surveillance Program and the Michigan Department of Natural Resources (MDNR), Alpena Field Station, are employing a new aging technique that may be better able to determine age quickly and accurately using the maxillary bone of lake trout. This new method is being compared to traditional methods, otolith and coded wire tags, in a blind comparison study between two laboratories to gauge accuracy, refine aging rules and techniques, and to allow for compositing of GLFMSP samples around a known age. Fish age is used to help explain the changes in fish tissue concentration for some legacy contaminants, like PCBs, in lake trout collected as part of the long term GLFMSP. Results of this collaboration may alter the standard collection procedures for the GLFMSP to better reflect the environmental condition.

**NAPERALA, TROY, P.E.,** *Michigan Water Business Line Leader, AECOM*

Troy Naperala has Environmental and Civil Engineering degrees from Michigan Technological University and the University of Virginia. He is a registered professional engineer in Michigan. His practice focuses on watershed restoration and includes BMP planning, design and monitoring; river and wetland restoration design; and water quality studies. He is fortunate to have projects in these areas in Michigan, Texas, Wisconsin, Minnesota, Maryland, Virginia and North Carolina and enjoys seeing and understanding the different design requirements posed by the climate and geology of these diverse locations.

**Advances in Design and Restoration Techniques Part 1**

**Boardman River Reborn - Community Lessons in Dam Removal**

**NEWCOMB, TAMMY,** *Senior Water Policy Advisor, Michigan Department of Natural Resources, Executive Division*

Dr. Tammy J. Newcomb serves as a Senior Water Policy Advisor for the Michigan Department of Natural Resources (MDNR). In her current role, she leads statewide issues for the Department such as groundwater withdrawal management, preventing Asian carp from entering the Great Lakes, and coordination of issues regarding management and research on Great Lakes Fisheries. She received her Bachelors of Science degree and Ph.D. in Fisheries and Wildlife from Michigan State University and her M.S. from West Virginia University in Forestry. Prior to her current appointment she served as the MDNR Fisheries Division Research Program Manager and earlier as the Lake Huron Basin Coordinator. Before she began service with the MDNR, Dr. Newcomb was an Assistant Professor at Virginia Polytechnic Institute and State University with a research program focused on management of regulated rivers.

**Status of Information and Issues Regarding Commercial Net Pen Aquaculture in the Great Lakes**

*Co-author: Michigan Department of Natural Resources, Fisheries Division*

Net-pen aquaculture is named for floating enclosures in open water that are capable of raising large numbers of fish. These operations take small fish from a hatchery and raise them to a harvestable size for the consumer food market. Currently, the only commercial aquaculture net pens in the Great Lakes are located in the Ontario waters of Lake Huron in the North Channel and in Georgian Bay.

The Michigan Departments of Agriculture and Rural Development, Environmental Quality, and Natural Resources have shared authorities over this newly proposed activity. While the regulatory framework addresses water quality, fish stocking, construction and use of bottomlands, and aquaculture facility registration, there are additional aspects to consider when contemplating this issue. The Departments are using an ecosystem management approach to frame the ecological, economic, regulatory, and social basis for developing state policy on this issue. In May, a multi-disciplinary science panel was convened to address specific issues pertaining to the ecological and environmental issues pertaining to the operation of net pens in the Great Lakes.

**NORTON, RICHARD K.,** *Professor and Chair, Urban and Regional Planning Program, University of Michigan*

Richard K. Norton is professor and chair of the Urban and Regional Planning Program at the University of Michigan. Dr. Norton, an urban planner and lawyer, studies the planning, policy, and legal aspects of coastal area management along Great Lakes shorelines.

**What Makes a Great Lakes Community "Coastal"?**

*Co-authors: Guy A. Meadows, Michigan Technological University; Catherine M. Riseng, University of Michigan*

Numerous efforts are under way to promote the adoption of state and local plans and policies designed to help make Great Lakes coastal communities more resilient. In order to promote coastal resiliency, it would be helpful to understand both what makes a community "coastal" as well as makes it "resilient," especially along a Great Lakes shore. Much attention has been given to defining "resiliency," but little attention has been given to determining what makes a Great Lakes community "coastal." Specifically, how far inland from a Great Lakes shore along connecting lakes and rivers constitutes coastal? One way to approach this question might be to consider physical conditions, such as the amount of riverine area subject to wave run-up during storms given different lake stillwater levels. Another would be to consider ecological conditions, such as the reach of spawning habitat for Great Lakes fishes. Yet another would be to consider the reach of Great Lakes water-dependent commercial and industrial activities, such as marinas. Each of these various ways of defining coastal may have implications in terms of contemplating what would make a community resilient, more broadly, and in terms of the applicability of various regulatory, public expenditure, and other programmatic plans and policies, more specifically. This session will assess these various ways of characterizing a Great Lakes community as "coastal" and discuss the key planning and policy implications for each, particularly in the context of promoting coastal resiliency.

**ORTEL, DAVID,** *Indiana State Department of Health*

**Building a Regional Partnership to Address Septic System Impacts to Lake Michigan**

*Co-author and presenter: Mike Molnar, Indiana Lake Michigan Coastal Program; Co-authors: Doreen Carey, Indiana Department of Natural Resources Lake Michigan Coastal Program, Natalie Johnson, Northwest Indiana Urban Waters Partnership, and Joe Exl, Northwest Indiana Regional Planning Commission*

Although failing septic systems have long been identified as a potential contributor to water quality impairments in NW Indiana, there is limited public awareness of the problem and the associated health, recreation, and economic impacts. All Indiana Lake Michigan tributaries are impacted by E.coli and although the contribution from failing septic systems is not well-documented, many existing systems are decades old and a large percentage of soils in the Lake Michigan watershed are identified as unsuitable for septic systems.

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**PARKER, TODD,** *Senior Manager, Delta Institute*
Todd Parker manages projects in the areas of ecosystem services, energy efficiency and pollution prevention, and facilitates the Lake Michigan Forum. A native of Ohio, Todd studied forestry at Michigan State University. After trudging around the forests of Alaska, Mississippi and Michigan and learning how legislation is crafted in the Michigan Senate, he attended the Vermont Law School, where he earned a Master's degree in Environmental Law. Now in his ninth year at Delta, Todd is continually reminded of the value of his work whenever he looks into the eyes of his daughter. There is no nobler profession than one that strives to make the world a better place for the children of tomorrow.

**Raising Public Awareness of Ecological Issues through the Love Lake Michigan Campaign**
*Co-presenter: Jennifer Estill, Redhead Design Studio*
Social media campaigns, using Twitter, Instagram and Facebook, are becoming the preferred means of reaching a large number of people with information. Many environmental organizations talk about having a social media presence, but do very little to leverage that presence. In 2014, the Lake Michigan Forum and Watershed Academy (LMFWA), with funding from the Great Lakes Restoration Initiative, launched the "Love Lake Michigan" campaign to promote the inherent value of Lake Michigan. This social media focused, public engagement campaign encourages individual and collective action toward implementation of Lake Michigan Lakewide Action and Management Plan (LAMP) priorities. Key elements of this campaign are the #LoveLakeMichigan hashtag and the Love Lake Michigan (www.lovelakemichigan.org) web site. This site is the primary entry point for citizen engagement. Through social media, marketing materials, and personal outreach at local events, the LMFWA is driving citizens to this site, where they can view the Lake Michigan 101 training modules, volunteer for community events, provide feedback to EPA on Lake Michigan LAMP priorities, and take the "I Love Lake Michigan" pledge for Lake Michigan stewardship. This campaign continues to increase public awareness of issues related to the water quality of Lake Michigan, expand the range of opportunities for Great Lakes stakeholders and citizens to provide input to the governments and participate in Great Lakes issues and concerns and catalyze individual and collective action toward ecosystem stewardship. In this workshop, the Lake Michigan Forum will discuss the creation, branding, management, implementation and impact of this social media campaign. We will present a variety of media and discuss how we have been able effectively harness the power of social media to increase awareness of the inherent value of Lake Michigan. We will also discuss how organizations can creatively and effectively brand their outreach campaigns for maximum exposure.

**PELLER, JULIE,** *Associate Professor of Chemistry, Valparaiso University*
Dr. Peller is an Associate Professor of Chemistry at Valparaiso University. Her research as an Environmental Organic Chemist is mostly in the area of organic water contaminants. A significant portion of her work is performed at the University of Notre Dame's Radiation Laboratory, where she holds a Visiting Scholar appointment. Dr. Peller's research also includes work with the U.S. Geological Survey, Lake Michigan Ecological Research Station in Porter, Indiana, investigating challenges to surface waters and Lake Michigan, including water quality effects of decaying Cladophora. Dr. Peller is active in local school and community environment and watershed awareness projects and initiatives. She is vice president of the Hoosier Environmental Council (HEC) board.

**Integrated watershed monitoring programs for the protection of Northwest Indiana surface waters**
*Co-authors: Laurie Eberhardt, Valparaiso University; Erin Argyilan and Dan Kelly, Indiana University Northwest*
Lake Michigan and its watershed constitute significant sources of fresh ground and surface water in Northwest Indiana. Stressors of the fresh water bodies range from industry, for which the lakeshore was populated, to urbanization and agriculture. In order to adequately monitor the health of the extensive watershed tributaries that flow into Lake Michigan, customized observations (surveys) and basic water quality parameters, both chemical and biological, can be collected, analyzed and stored. The information can lead to an understanding of the type and extent of water pollution sources, as well as engaging the local community to work towards solutions to problems, especially when the monitoring is consistent and long-term. However, this approach requires many committed and interactive organizations. Current Northwest Indiana watershed monitoring programs, such as GLISTEN (The Great Lakes Innovative Stewardship Through Education Network), utilize local resources for the collection of datasets by science teachers, students and interested community organizations in collaboration with scientists from the local universities, community college and government labs. Over the past year, surface water chemistry data from the Coffee Creek and Salt Creek watersheds in Northwest, Indiana have been collected, analyzed

and catalogued and a subset of this information will be presented. The most recent program initiative focuses on a portion of the Salt Creek watershed in Portage, Indiana and partners Portage middle schools with university students and faculty to create useful datasets and greater community awareness of the local fresh water challenges. Additionally, the Hoosier Environmental Council, Save the Dunes and the Northwest Indiana Regional Planning Commission are contributing their expertise to increase student and community awareness of the watershed. These early program results will also be presented.

**PREISSER, MATT,** *Lake Michigan Coordinator, Michigan Office of the Great Lakes*
Matt has almost twenty years of experience engaging in multi-disciplinary natural resource policy, planning, and management. Among his various roles, Matt represents the State of Michigan on the Lake Michigan Lakewide Action and Management Plan (LAMP) Partnership and advances related commitments under the bi-national Great Lakes Water Quality Agreement; serves on the State of Michigan Aquatic Invasive Species Program and a number of other internal and external committees; and contributes to other projects to protect and restore our Great Lakes and support our vital coastal communities. As a coordinator, he often focuses on improving communication and synergy between organizations. Matt holds a Bachelor of Science (biology) degree from Bucknell University and a Master of Environmental Management (resource ecology) from Duke University.

**Sharing Solutions between Beaver Island, Michigan and Maine Island Communities – Building Local Capacity through Community Exchanges**
*Co-Authors: Pam Grassmick, Board Member, Beaver Island Association; Heather Deese, Vice President, Strategic Development, and Karen Burns, Community Development Director, Island Institute; Jon W. Allan, Director, Michigan Office of the Great Lakes*
This project will initiate dialogue and create a novel coordination network between the Beaver Island community in Michigan and one or more of the unbridged island communities in Maine. Through first-ever community exchanges, community members from distant islands will compare challenges and share innovative solutions to achieve long-term island prosperity and sustainability. Secondarily, we will explore the potential to expand this collaborative network concept to other Great Lakes and Maine island communities. Presently, regular dialogue between island communities within the Great Lakes is limited, and functionally non-existent between the Great Lakes and coastal Maine. There is great potential for islanders to learn from one another about a variety of pressing issues facing their unique communities. The project contains three primary components: a kick-off "open house" community meeting on Beaver Island and two "knowledge exchange trips" between the islands in Michigan and Maine. The project tasks are set up for one year; however we envision the project serving as a springboard for long-term, broader coordination and communication between the islands. Programmatic, technical, and logistical support will be provided by the Island Institute and the Michigan Office of the Great Lakes.

**REDING, SARAH**, *Vice President of Conservation Stewardship, Kalamazoo Nature Center*
Sarah Reding is the Vice President of Conservation Stewardship. She has worked for the Kalamazoo Nature Center (KNC) for 25 years and currently oversees KNC's Research and Ecological Management programs. These programs involve research on a local to national level, habitat restoration, land management and biological assessment. She is also responsible for the development of KNC's Citizen Science programs and interpretation of conservation on the KNC site. She is currently on the board of the Michigan Bird Conservation Initiative, the Kirtland Warbler Alliance, and has conducted consultation with nature centers and programs around the country. She has a master's degree from Western Illinois University in Recreation and Park Administration, with an emphasis in biology.

**Michigan's Water Heritage Project: Our Stories about Water**
*Co-authors: Michael Stachowoiak, Mike Stafford, and Lisa Appel, Cranbrook Institute of Science; Kurt Dewhurst, MSU Museum; Bill Rose, Kalamazoo Nature Center; Jon Allan and Emily Finnell, Michigan Office of the Great Lakes*
Michigan's water resources are the foundation of the state's past, present and future prosperity. They have been the catalyst for the economic development that moved us to international prominence, but are also integral and deeply rooted in our

quality of life. Policy and decision makers at all levels of governance continue to face tremendous challenges around water use and water quality such as non-point source pollution, invasive species introductions, competing demands for ground water, and impacts from changes in weather patterns. Water conflicts are already arising in parts of Michigan and generations are becoming disconnected from nature and government decision making resulting in a need for capacity at the community level in order to address and resolve these conflicts. For this reason, the Michigan Office of the Great Lakes implemented an innovative Water Heritage project in collaboration with Cranbrook Institute of Science; Kalamazoo Nature Center; and the Michigan State University (MSU) Museum with MSU's Office of University Outreach and Engagement supported by the Erb Family Foundation. The project focus is to increase the ability of individuals to engage in influencing and informing water resource policy, and improving government's ability at all levels to communicate, engage, and listen to individuals tell their story about why water matters to them personally by building support and capacity for shared governance. These partners believe that human experience, things like engagement and citizenship, our affinity to each other, and to our love of water and place can be used as a catalyst for public dialogue about water resources, and that shared cultural experiences contribute to a sense of place and communal identity.

**RISENG, CATHERINE,** *Assistant Research Scientist, University of Michigan*

Dr. Catherine Riseng is an Assistant Research Scientist at the University of Michigan, School of Natural Resources and Environment, and Research Program manager at Michigan Sea Grant. She is currently the PI of the Great Lakes Aquatic Habitat Framework (GLAHF) project along with two related projects to develop web-based Decision Support tools and a coastal condition assessment. She has extensive field experience in with benthic communities in both the Great Lakes and its tributary watersheds. She has conducted regional assessments of river ecosystems in the Great Lakes region and currently manages several large research projects.

**A geospatial framework and spatially referenced decision tools for Great Lakes management**

*Co-author and presenter: Kevin Wehrly, Michigan Department of Natural Resources, Institute of Fisheries Research*

*Co-authors: Rob Goodspeed, University of Michigan, Urban Planning; Ed Rutherford, NOAA-GLERL; Li Wang, IJC; Lacey Mason, University of Michigan, SNRE; Ben Schoenfeldt, University of Michigan, SNRE*

The GLAHF is a spatial framework and database of physical, chemical and biological data covering the entire Great Lakes basin. These data are georeferenced to a common spatial grid, the framework, which facilitates lake-wide and basin-wide management activities. Great Lakes agencies, managers, and researchers commonly express a need for publically accessible consistent habitat data and decision support tools that can be applied to the multitude of problems that face aquatic ecosystems throughout the basin. The GLAHF project team has developed a number of web-accessible tools to assist with habitat monitoring, assessment, and prioritization for protection and restoration including: a scalable habitat classification framework; a GIS data viewer and server; and, a web-based decision support system to facilitate research and management activities in the Great Lakes. These spatially structured tools have been developed based on feedback from managers and experts directly involved with making management decisions in the basin and address their specific information needs. GLAHF and theses decision tools could be used to develop lake-wide management plans, prioritize locations for funding and specific management actions, and to conduct research for science-based decision making.

**ROBERTS, VIRGINIA A., MSPH,** *Epidemiologist, Centers for Disease Control and Prevention (CDC)*

Virginia A. Roberts, MSPH is an Epidemiologist in the Waterborne Disease Prevention Branch within CDC's National Center for Emerging and Zoonotic Infectious Diseases. She coordinates a CDC Great Lakes Restoration Initiative project with a focus on waterborne disease prevention capacity in Great Lakes states. She manages the waterborne disease outbreak module of the National Outbreak Reporting System (NORS) and collaborates with state health departments and federal partners on related outbreak health surveillance and reporting activities.

**One Health Surveillance of Harmful Algal Bloom-related Illnesses – A Reporting System Pilot**

*Co-authors: Joana Yu, Karna LLC; Irina Pyrkh, Northrop Grumman Corporation; Lorraine Backer, CDC; Kathleen Fullerton, CDC; Jonathan Yoder, CDC; Michael Beach, CDC*

Waterborne disease outbreaks are reported to the U.S. CDC by state health departments via the web-based National Outbreak Reporting System (NORS). Human outbreaks associated with exposure to harmful algal blooms (HABs) may be

reported. However, these outbreaks do not include individual-level data needed to improve case definitions or to prioritize other HAB-related activities. In 2013, CDC was funded by the Great Lakes Restoration Initiative (GLRI) to build waterborne disease prevention capacity in Great Lakes states and improve surveillance of HAB-related illness. CDC established a working group of state and federal partners with expertise in harmful algal blooms and illness surveillance to develop an electronic reporting system for HAB-related illnesses linked to NORS. The system will utilize a one health approach—receiving and linking reports of single cases of human illness, animal illness, and HABs. During 2014 and early 2015, the HAB working group drafted reporting forms for cases of human illness, animal illness, and HABs; and initial case and HAB definitions. A reporting system pilot will be initiated with the working group in summer, 2015. A full launch in 2016 and maintenance of the system will require ongoing efforts to support state activities and to demonstrate the value of the data through improved reporting definitions and data use. This presentation will provide background on this project and demonstrate pilot reporting site features.


**SCHLEIZER, BILL,** *Managing Director, Delta Institute*

Bill Schleizer serves as Managing Director, overseeing project management, finance, administrative and development of strategy across the organization. He leads several project areas, including those related to climate, agriculture, water and ecosystems and also provides expertise and technical assistance directly related to Delta's strategic priority areas. He holds a B.S. in Ecology, Evolution, and Organismal Biology and Environmental Studies from Tulane University and a M.S. in Environmental Analysis and Decision Making from Rice University.

**Incorporating Green Infrastructure into Local Decision Making in Michigan City, Indiana**

Delta Institute is partnering with Michigan City and its Redevelopment Commission, Haas and Associates Engineers, and The Alliance for the Great Lakes on Michigan City's Wabash Street Green Infrastructure Project. This project will result in the installation of stormwater Best Management Practices, including rain gardens and bioswales. Other improvements include the addition of sidewalks and crosswalks, as well as safety modifications to intersections. Landscaping, streetscaping, and LED lighting will also be added to create an aesthetically-pleasing environment. Delta will be developing green infrastructure templates and decision support tools that will guide the implementation of core green infrastructure components both for this project and for future projects in Michigan City. Grants from the U.S. Environmental Protection Agency, Donnelley Foundation, and the Indiana Lake Michigan Coastal Program have made the Green Infrastructure project possible.

**SCHLECK, BRENT,** *Coastal Storms Outreach Coordinator, Minnesota Sea Grant*

Brent Schleck is an Extension Educator with Minnesota Sea Grant, helping to coordinate the National Oceanic and Atmospheric Administration's (NOAA's) Coastal Storms Program in the Great Lakes region. The Coastal Storms Program is a regional effort working to improve community resiliency to coastal storm hazards. Brent's work focuses on municipal climate-change adaptation strategies, beach-goer safety, and improving community resiliency to storm impacts. Brent has a Master of Urban Planning degree from the University of Michigan and has experience working with communities around the Great Lakes region.

**Be Current Smart: Targeting Parents and Teens to Improve Water Safety**

*Co-authors and presenters: Gene Clark, Wisconsin Sea Grant Institute; Elizabeth LaPorte, University of Michigan*

Launched in May 2015, the Be Current Smart water safety campaign (CurrentSmart.org) is a collaboration of the NOAA Sea Grant and Coastal Zone Management programs. The campaign is focused on information about new water safety and rescue equipment, primarily targeting young men and parents. This regional campaign focuses on 1) outreach materials like video animations, news releases, and social media resources; and 2) water safety and rescue equipment (e.g., life jackets, throw rings, and rescue boards) deployed at Great Lakes beaches. The project team has distributed nearly 2000 pieces of equipment to communities and beaches in Minnesota, Wisconsin, Michigan, Indiana, and Illinois. Many of the beaches receiving equipment are not guarded; therefore, there is no safety equipment and rescues are often dependent on First

Responder response times. Having equipment at these beaches could turn a potential drowning into a successful rescue. Additionally, the CurrentSmart.org website hosts outreach materials informed by social science research conducted through MDEQ-OGL-Coastal Management Program and the NOAA Coastal Storms Program.

Through this session, attendees will learn about current and future water safety efforts conducted. Additionally, attendees will hear lessons learned from project leaders about the first phase of implementation, such as best practices for engaging local water safety working groups in six states; safety and rescue equipment distribution and maintenance; the initial analysis of social media strategies for the Be Current Smart campaign; and ideas for sustaining a regional water safety network, including Sea Grant, university experts, first responders, non-governmental organizations, as well as state, local and federal government agencies. The project is led by Illinois-Indiana, Michigan, and Wisconsin Sea Grant programs, in partnership with five Coastal Management programs, and Minnesota and Ohio Sea Grant programs. The NOAA Coastal Storms Program is supporting this project.

**SHIVELY, DAWN,** *Research Assistant, U.S. Geological Survey, Lake Michigan Ecological Research Station*

Dawn Shively is a research assistant with U.S. Geological Survey (USGS), Lake Michigan Ecological Research Station (LMERS) contracted through Michigan State University. She obtained a Bachelor of Science degree in Biology at Indiana University northwest campus in 2001, with a concentration in ecology and microbiology. She has over 17 years of microbiology experience, and has worked with the USGS for the past 15 years. She was involved in the conception of the microbiological program at LMERS and is currently the microbiology laboratory manager. Her research interests include microbial ecology, molecular microbiology, and recreational water quality and public health. She has co-authored/authored numerous articles published in refereed scientific journals and investigative reports related to recreational water quality in the Great Lakes basin. Other interests are statistical analysis and empirical predictive modeling for bacteria concentrations at recreational beaches.

**QPCR: A rapid method to monitor water quality at a National Park**

Novel, genetic techniques, such as quantitative polymerase chain reaction (qPCR), are increasingly used in water quality monitoring programs. To evaluate qPCR as a viable, alternate method for monitoring beach water quality, the USGS, in collaboration with National Park Service at Sleeping Bear Dunes National Lakeshore, compared qPCR side-by-side with a culture-based method using enterococci as the indicator bacteria. Individual water samples were collected at three sites from two beaches [Platte Point Bay (PP) and Esch Rd (ER)] and their adjacent streams [Platte River outlet (PR) and Otter Creek beach (OC)] between August and September 2014. Samples were analyzed for culturable (colony-forming units, CFU) enterococci (ENT) and their corresponding calibrator cell equivalents (CCE) by qPCR methods. Enterococci CCE were significantly correlated with CFU at all locations, except ER. Likewise, ENT CCE were significantly higher ($p<0.001$) than their corresponding CFU at all locations, except ER. Power analysis of intensive sampling results– five replicates each at ER and OC locations on nine occasions – revealed that at least 2 and 24 samples (ER) and 1 and 4 samples (OC) would be required to attain a 70% precision for CFU and CCE results, respectively. Using closures/advisories for safe swimming, there would be fewer exceedances with qPCR results (3/99than with CFU results (17/98), with all exceedances occurring at OC. To our knowledge, Sleeping Bear Dunes National Lakeshore is the first national park in the Midwest to evaluate qPCR as a viable, alternate method for monitoring its beaches. With same-day results, qPCR technology could potentially prevent unnecessary beach closures and better protect the public from exposure to contaminated waters. Other potential applications include surveillance of C. botulinum – the causal agent of botulism – that remain a threat causing extensive mortalities in shoreline birds in the lower Great Lakes.

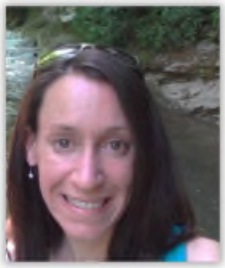
**SNYDER, ASHLEY**, *RAP and LAMP Program Coordinator, Indiana Department of Environmental Management*

Ashley Snyder is the Grand Calumet River Area of Concern Remedial Action Plan Coordinator and the Lake Michigan Lakewide Action and Management Plan Coordinator with the Indiana Department of Environmental Management (IDEM). Ashley has been in her current position since 2011 and has previous work experience as a Solid Waste and Confined Feeding Operations Compliance Inspector with IDEM, an Environmental Manager in a large steel mill on the southern tip of Lake Michigan, and as a wet chemistry lab coordinator for a private environmental laboratory in Illinois. Ashley is a 2007 graduate of Valparaiso University with a B.S. in Chemistry.

**Indiana's Clean Marina Program Implementation and Collaboration**

*Co-authors: Dorreen Carey, Indiana Department of Natural Resources Lake Michigan Coastal Program*

The Indiana Clean Marina Program was developed in an effort to protect our state's inland and coastal waterways by reducing the potential environmental impacts associated with marinas and recreational boating. The Indiana Clean Marina Program provides information, technical assistance, and guidance to marinas and recreational boaters. By participating in this voluntary program, marinas, boatyards, yacht clubs, and recreational boaters are recognized for their environmental stewardship. The Indiana Clean Marina Program is a collaborative effort by the IIDEM, the Indiana Department of Natural Resources, marinas, boatyards, yacht clubs, and recreational boaters. Development of the Indiana Clean Marina Program was made possible with financial assistance awarded to the Lake Michigan Coastal Program by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration (NOAA) under a Section 310 grant. The Indiana Clean Marina Program was piloted in the Lake Michigan Coastal Program area in May of 2008. Due to the success of the program, it has been approved for a statewide expansion. This presentation will focus on the highlights of Indiana's program as well as the collaboration between State agencies and with the Great Lakes Clean Marina Network.



**STEIN, SARAH, R.**, *Purdue University, Department of Forestry and Natural Resources*

Sarah Stein is a PhD candidate in Purdue University's Department of Forestry and Natural Resources. Her dissertation research investigates the influences of river plumes and rivermouths on fish recruitment and food webs in southern Lake Michigan. She is interested in how physical and chemical processes affect fish population dynamics and trophic interactions. Additionally, Sarah is interested in utilizing adaptive natural resource management to restore altered aquatic ecosystems. Both during and prior to her PhD, Sarah has been involved in outreach activities with diverse stakeholder groups.

**Resource Subsidies for Young Fish in Southern Lake Michigan Rivermouths**

*Co-authors: Gabriel J. Bowen, University of Utah, Department of Geology and Geophysics; Cary D. Troy, Purdue University, School of Civil Engineering; Tomas O. Höök, Purdue University, Department of Forestry and Natural Resources*

Rivermouth consumers derive energy from spatially diverse habitats. Trophic linkages between tributaries and coastal zones can facilitate complex food webs, where fish benefit from subsidies that originate in adjacent systems. In southern Lake Michigan, tributaries deliver seasonally warmer, nutrient enriched water into the relatively cool, oligotrophic lake. Through their unique physical and chemical processes, rivermouth mixing zones may provide important nursery habitat for fish. Despite burgeoning interest in the nearshore Lake Michigan food web, energy dynamics and nutrient transfers in rivermouths are understudied. To explore resource utilization by fish in three southern Lake Michigan rivermouths, we characterized trophic interactions among young round goby, yellow perch, alewife, and their prey. We selected these species because they utilize nearshore habitat in Lake Michigan, and they have different life-history strategies. Fishes were analyzed for gut contents and stable isotopes of carbon, nitrogen, hydrogen, and oxygen of tissue. To further explore trophic linkages, we quantified fatty acid signatures of fish tissue and prey. Our characterization of rivermouth food webs indicates that young fishes are utilizing a variety of tributary and nearshore lake resources. Fishes consumed similar prey types across habitats; however, isotope and fatty acid results suggest that round goby and yellow perch exhibited resource specialization while alewife were subsidized by external resources. Additionally, Lake Michigan may contribute more to rivermouth production than the tributaries supplement lake production. Overall, rivermouth subsidies were highly variable across species and systems. These transitional habitats may facilitate early-life growth and survival of Lake Michigan fish. Our investigation likely has broader implications for the recruitment of these ecologically and economically important fishes throughout the Laurentian Great Lakes.

**STRUFFOLINO, PAMELA,** *Operations & Research Facilitator, University of Toledo*

Pamela Struffolino received her MS degree at the University of Toledo where her area of focus was recreational health. After graduation, she continued working at the University as a lab technician for Dr. Dwyer. She has worked in the area of beach health for the past 13 years and continues beach monitoring and constructing the predictive module used at the Maumee Bay State Park lake side beach.

**Improving Water Quality for Maumee Bay State Park: Restoring Ecosystems for Health**

*Co-authors: Ryan, Jackwood; Daryl F. Dwyer*

Maumee Bay State Park (MBSP) issues swim advisories for beaches during the recreational season (May to September) due to excessive amounts of Escherichia coli and algae present in Lake Erie water. Water and bed-sediment samples were collected from 24 locations with potential influence on MBSP beaches in the Maumee Bay region including: Toledo shipping channel, Maumee River, and nearby drainage ditches. The Wolf Creek watershed (39.9 km2) which discharges into Lake Erie on MBSP property was identified as a proximal source of contamination to the beaches. GLRI funding was used to restore a riparian habitat and a wetland along the Wolf Creek watershed to reduce loadings of E. coli, sediment, and nutrients. The riparian restoration consisted of a broadening and deepening of the creek channel to slow water flow and remove both suspended and rolling bed sediment. The restored wetland was designed for subsurface flow to promote adsorption and filtration of nutrients and bacteria. Post-construction findings indicate reductions of 85 % for E. coli, 50% for sediment and 50% for phosphorus after treatment from the riparian habitat (only data from riparian habitat is currently available). The riparian habitat and wetland are prototypes that will be fully operational in spring 2015 and can be used throughout the Great Lakes' watersheds as viable restoration options that reduce nonpoint source contamination. Water quality monitoring will continue within the Wolf Creek watershed and MBSP beaches throughout the 2015 recreational season and beyond. Preliminary results indicate a significant decrease of E. coli loadings from the Wolf Creek watershed, which we anticipate to improve beach health and decrease swim advisories in the coming years.

**U'REN, SARAH,** *Program Director, The Watershed Center Grand Traverse Bay*

Sarah U'Ren has served as Program Director for The Watershed Center Grand Traverse Bay since 2002. She authored the Grand Traverse Bay Watershed Protection Plan, administers The Watershed Center's many grant-related programs, and directs The Watershed Center's beach monitoring program. Sarah holds a B.S. in Science from Alma College and a Master's in Environmental Science from the University of Maryland and specializes in beach and stormwater runoff management.

**Utilizing Partnerships and Green Infrastructure to Restore Kids Creek**

The Watershed Center Grand Traverse Bay is a nonprofit organization based in Traverse City, Michigan whose mission is to advocate for clean water in Grand Traverse Bay and protect and preserve the Bay's watershed. This presentation will focus on the key partnerships that were formed by The Watershed Center as part of our efforts to reduce stormwater and sediment inputs to Kids Creek, an impaired waterbody in the Grand Traverse Bay watershed. One of the focuses of the ongoing Kids Creek Restoration Project is installing green infrastructure and low impact development techniques in the urban areas of Traverse City that drain to Kids Creek. Key partnerships were formed with a local hospital, senior center, and other large landholders that enabled large-scale projects to be initiated and grant funding to be obtained to complete various projects including: daylighting 900 feet of the creek contained in underground culverts; eliminating 72,000 square-feet of impervious surfaces; and installing green roofs, underground infiltration trenches, rain gardens, pervious pavement and more. So far, project funding totals over $3.4 million from Federal and State grants, as well as local match and private funding.

**VAIL, JANET,** *Research Scientist, Annis Water Resources Institute, Grand Valley State University*
Dr. Janet Vail, research scientist, heads up the vessel-based outreach and education program at the Grand Valley State University (GVSU) Annis Water Resources Institute. That program provides hand-on science experiences for over 5,000 students and others per year. Dr. Vail serves as co-chair of the Lake Michigan Forum and was the chairperson of the first three State of Lake Michigan Conferences.

**Making Lake Michigan Great: An Onboard Outreach and Education Project**
*Co-authors: Shirley McIntire and Michele Smith, GVSU Annis Water Resources Institute*
Since 1998, GVSU's Annis Water Resources Institute has conducted Making Lake Michigan Great tours using its research and education vessels, the W.G. Jackson and the D.J. Angus. Throughout the years, 33 ports of call have been reached in the Lake Michigan basin. The purpose of these yearly tours has been to spread the word about the Lake Michigan Lakewide Action and Management Plan, the Lake Michigan Forum, and the Great Lakes Restoration Initiative as well as to highlight local stewardship efforts. This is done through a variety of activities such as onboard water sampling and analysis, open houses, and educator workshops. At each port, local hosts arrange the logistics and they share the results of their stewardship efforts in their port and watershed with the participants. The U.S. Environmental Protection Agency's Great Lakes National Program Office has supported the tours since 1998. Recently, other entities such as the Sanitary District of Michigan City have funded vessel visits. Participants in Making Lake Michigan Great events develop greater awareness of the importance of Lake Michigan and how federal, state, local and individual efforts make a difference.

**VERHAMME, ED,** *Project Engineer, LimnoTech*
Mr. Verhamme is a Project Engineer with LimnoTech and has been involved on a variety of Great Lakes projects, including hydrodynamic modeling and application of water quality models, since joining the firm in June 2005. This includes the Saginaw Bay Multiple Stressors project, Lake Champlain phosphorus mass balance, and other Great Lakes modeling projects on the Buffalo River, Niagara River, Maumee Bay, Sandusky Bay, western Lake Erie, southern Lake Michigan, and western Lake Superior. In addition to modeling, Mr. Verhamme has been involved with several projects, including the development of smartphone applications and working to deliver real-time observations to Great Lakes Communities through a public buoy network, and on projects with the Great Lakes Observing System.

**Green Bay Nutrient, Hypoxia, and HABs Model: Development, Application, and Management Implications**
*Co-authors: Joseph V. DePinto, LimnoTech; Shelby LaBuhn, University of Wisconsin-Milwaukee; J. Val Klump, University of Wisconsin-Milwaukee; Hector Bravo, University of Wisconsin-Milwaukee*
Recent research on Green Bay has highlighted the complex connections between physical, nutrient, and biological drivers in the bay that contribute to hypoxia and eutrophication issues. A state-of-the-science ecosystem model, termed the Advanced Aquatic Ecosystem Model (A2EM), was recently applied to the Green Bay system to help researchers and managers understand these interactions and identify management actions that could improve water quality conditions. The model uses a fine-scale, three-dimensional grid to dynamically simulate bay circulation, temperature, nutrient loading from tributaries and internal sediment release, dissolved oxygen, phytoplankton (including blue greens), and zooplankton. The model was calibrated and applied to the years 2011 and 2012. A series of scenarios, which were informed with watershed BMP implementation guidelines, were run to create a Management Analysis Tool (MAT). The MAT will assist decision makers in choosing appropriate and cost effective watershed actions to improve bay water quality. The presentation will highlight the development, calibration, and application of the model as well as discuss the MAT tool and how it will be used locally to help transfer research findings to managers.

**VOGEL, LAURA,** *PhD Candidate, University of Western Ontario*

Laura completed her Undergraduate and Master's degrees in Environmental Engineering and Civil Engineering, respectively at the University of Miami. She is currently a PhD candidate at the University of Western Ontario in the Civil and Environmental Engineering department where she is focusing on microbial water quality at recreational beaches.

**Methods to sample E. coli in foreshore sand and pore water**

*Co-authors: Denis M. O'Carroll, University of Western Ontario; Thomas A. Edge, Environment Canada; Clare E. Robinson, University of Western Ontario*

In recent years, a number of studies have shown microbial contaminants, including fecal indicator bacteria (FIB) such as E. coli, accumulate in sand and porewater close to the shoreline at beaches. This reservoir of bacteria can act as a non-point source resulting in elevated microbial levels in adjacent surface waters. While, surface waters at many recreational beaches are routinely monitored by health units following recommended sampling guidelines, there is no widely-accepted method to collect sand/sediment or porewater samples for FIB enumeration. The attachment efficiency of FIB to different types of sand grains and under different moisture conditions adds additional uncertainty to characterizing the abundance of E. coli in the foreshore reservoir. Some studies have quantified the abundance of E.coli in the foreshore reservoir by collecting unsaturated surface sand samples, while other studies sample the pore water and disturbed saturated sand samples. The utility of the different sampling strategies in providing quantifiable information related to the abundance of FIB in the foreshore reservoir and associated risk is not well understood. Field sampling was conducted to evaluate techniques for characterizing the abundance of E. coli in the foreshore reservoir. Sampling was performed at a range of beaches with different sand types including fine grain (0.125<d50<0.250 mm), medium grain (0.251<d50<0.500 mm), and coarse grain sand (0.501<d50<1.00 mm). Multiple techniques were used to sample the foreshore reservoir, including collection of porewater samples (drive point, shovel, and careful excavation) and saturated sand samples (sediment core, shovel, and careful excavation). This data will help determine the optimal sampling strategy for characterizing FIB abundance in the foreshore reservoir. This understanding is critical to work toward developing a standard recommended method for quantifying the abundance of FIB in the foreshore reservoir as required to ultimately evaluate the associated water quality impairment and public health risk.

**WATHEN, JOHN,** *Senior Scientist, U.S. Environmental Protection Agency, Office of Water*

John Wathen is now senior scientist for fish and beach programs in the Standards and Health Protection Division of the Office of Science and Technology in the U.S. Environmental Protection Agency's (U.S. EPA's) Office of Water. He served as assistant or acting chief of the Fish, Shellfish, Beaches and Outreach Branch (FSBOB) since coming to the U.S. EPA, until it was combined recently with the National Standards Branch. Mr. Wathen received his B.A. in Geology from Northeastern University and an M.S. in Earth Sciences from the University of New Hampshire. He worked as a consulting hydrogeologist for 15 years, primarily in northern New England, and served as Southern Maine Regional Director of the Maine Department of Environmental Protection 2000-2005, before joining the U.S. EPA. He provides technical support to the BEACH Act monitoring and advisory program, National Fish Advisory Program, and OW's fish tissue contaminant studies, focusing on human health implications. Mr. Wathen is a Maine Certified Geologist, a Registered Geologist in Kentucky, and a Certified Ground Water Professional.

**EPA's Beach Program- Looking forward to 2016**

The U.S. EPA's Beach Monitoring and Advisory Program operated in a normal manner in 2015 despite a climate of uncertainty that will continue to affect the future of the program for the foreseeable future. In a way, the uncertainty of funding has caused the program to streamline itself and the way business is carried out: grants, data processing, reporting, and relations with the regions and with the states. Changes to the program associated with the 2012 Recreational Water Quality Criteria (RWQC) and 2014 Beach Guidance and Required Performance Criteria for Grants have stimulated the entire beach community to revisit public health protection thresholds and re-think the beach health protection paradigm, incorporating sanitary surveys to a greater extent, as well as predictive models and qPCR. In the spring of 2016, the Beach Program will hold its first conference since 2011. The theme of the conference will be the changes to beach monitoring, water quality, and

public health protection that have taken place since the release of the 2012 RWQC. Discussions will include how states are implementing the new criteria and what the future of the program holds at the state, great water body, and federal levels. This presentation will provide a glimpse forward to the U.S. EPA conference, will serve as a forum for input to the conference, and provide a means for the Great Lakes beach community to have a say in the tenor, tone, and content of the conference.

**WATSON, NICOLE,** *Graduate Research Assistant, Central Michigan University*

Nicole Watson is a graduate student at Central Michigan University studying juvenile steelhead in collaboration with Michigan Department of Natural Resources. Nicole is an avid traditional archer, hunter, and fly fisher. She loves working with cold-water fish species both in the streams and in the deep waters of the Great Lakes. She has most recently worked with USGS at the Great Lakes Science Center participating in a broad array of field studies investigating the ecology of the Great Lakes and their fish populations. Her graduate research is focused on steelhead and how streams with unique water chemistry result in unique chemical signatures in fish otoliths. Her work will provide valuable insight into the early life history and habitat preferences of steelhead prior to migration to the Great Lakes.

**Lake Michigan Steelhead: Where were you hatched?**

*Co-authors: Steven Hummel; Jory Jonas; James Student; Kevin Pangle*

Lake Michigan steelheads, Oncorhynchus mykiss, are a mix of hatchery-produced and wild fish, the latter originating from many different natal tributaries within the lake basin. Mixed stock populations can complicate conservation and management due to unequal contributions from various stocks, thus making it necessary to understand the natal origins of such populations. We evaluated the use of otolith chemistry as an approach to identify the natal origin of Lake Michigan steelhead. Using laser-ablation inductively coupled plasma mass spectrometry, we analyzed the otoliths of juvenile steelhead collected in 2013 and 2014 from 46 Michigan and Wisconsin tributaries of Lake Michigan. We found distinct chemical signatures occurring between fish from different natal streams and hatcheries that could be used to predict natal origin with a high degree of accuracy. Strontium was found to be the most important trace element for discrimination, with highest natural values occurring in the Manistee River. Our results clearly demonstrate the utility of otolith chemistry and pave the way for future studies to determine the natal origins of adult steelhead, thus benefiting the management of both steelhead and their natal habitats.

**WATSON, SUE, Dr.,** *Watershed Hydrology and Ecology Research Division, Environment Canada*

**Beach Bloom Risk Management: Development and Implementation of On-Site Response Tools**

*Co-authors: G.L. Boyer, State University of New York College of Environmental Science and Forestry; E. Mathews, Hamilton Public Health Services; Arthur Zastepa and Thomas Edge, Environment Canada*

Cyanobacteria Harmful Algal Blooms (cHABs) threaten drinking and recreational water aesthetics and safety, and increasingly, are a major cause of beach postings and closures. Some, but not all of these blooms produce toxins, notably microcystins (MCs), which are not only accumulated in the cells but can persist for several weeks after bloom decay. Beach monitoring and management for bacterial levels is well established across much of Canada and the US, but there are relatively few comparable programmes for cHABs, although recreational guidelines are in place for safe MC exposure levels in many jurisdictions. Recreational/health agencies and managers need reliable, cost-effective and rapid methods to assess bloom material and toxins, which cannot be met by most lab turnaround times. cHABs blooms are often unpredictable and wind-blown shoreline material can contain toxin levels ranging over an order of magnitude. In this talk we describe the successful development and implementation of a cHAB beach Bloom Risk Management Programme (BRMP) for Hamilton Harbour, an eutrophic embayment in Lake Ontario where cHAB-related beach closures are a common problem. This involved a rigorous assessment of commercial MC field test kits, the development of a tiered BRMP and their incorporation into the existing bacterial beach monitoring programme carried out by the local health agency.

**WEHRLY, KEVIN**, *Research Biologist, Michigan Department of Natural Resources, Institute for Fisheries Research*

**A geospatial framework and spatially referenced decision tools for Great Lakes management**

*Co-author and presenter: Catherine Riseng, University of Michigan (U-M)*
*Co-authors: Rob Goodspeed, University of Michigan, Urban Planning; Ed Rutherford, NOAA-GLERL; Li Wang, IJC; Lacey Mason, University of Michigan, SNRE; Ben Schoenfeldt, U-M, SNRE*

The Great Lakes Aquatic Habitat Framework is a spatial framework and database of physical, chemical and biological data covering the entire Great Lakes basin. These data are georeferenced to a common spatial grid, the framework, which facilitates lake-wide and basin-wide management activities. Great Lakes agencies, managers, and researchers commonly express a need for publically accessible consistent habitat data and decision support tools that can be applied to the multitude of problems that face aquatic ecosystems throughout the basin. The GLAHF project team has developed a number of web-accessible tools to assist with habitat monitoring, assessment, and prioritization for protection and restoration including: a scalable habitat classification framework; a GIS data viewer and server; and, a web-based decision support system to facilitate research and management activities in the Great Lakes. These spatially structured tools have been developed based on feedback from managers and experts directly involved with making management decisions in the basin and address their specific information needs. GLAHF and theses decision tools could be used to develop lake-wide management plans, prioritize locations for funding and specific management actions, and to conduct research for science-based decision making.

**WHITMAN, RICHARD, PhD.,** *Beach Scientist, U.S. Geological Survey, Great Lakes Science Center*

After working for NASA as a spacecraft sanitarian for the Skylab mission, Richard returned to his graduate studies at Texas A&M University where he received his Ph.D. in Wildlife and Fisheries Sciences in 1979. The following year he took an appointment at Indiana University NW where he taught ecology. In 1989 he was hired as the Indiana Dunes National Lakeshore's Chief Scientist transferring to the U.S. Geological Survey (USGS) in 1993. Dr. Whitman has published more than 100 scholarly papers that have generated over 3000 journal citations and is an internationally recognized expert in beach sciences. He retired last year and now splits his time between Florida and Chesterton remaining active in investigating and resolving beach problems.

**Evaluate immediate and long-term BMP effectiveness of GLRI restoration efforts at urban beach and nearshore sites of Southern and Western Lake Michigan**

*Co-authors: Paul Buszka, USGS, Indiana Water Science Center; Muruleedhara Byappanahalli, USGS, Great Lakes Science Center; Steve Corsi, USGS, Wisconsin Water Science Center; Jim Duncker, USGS, Illinois Water Science Center; Ryan Jackson, USGS, Illinois Water Science Center; Julie Kinzelman, City of Racine WI, Department of Health; Meredith Nevers, USGS, Great Lakes Science Center*

The USGS and Racine Health Department will evaluate data that indicate the effectiveness of beach restoration activities that are intended to improve contact recreational water quality at three beach sites: North Beach, Racine, WI; 63rd St. Beach, Chicago, IL; and Jeorse Park Beach, East Chicago, IN. Evaluation of these activities is directed to assess whether beach restoration goals are being achieved and to identify developing unforeseen consequences. Projections and potential challenges associated with climate change impacts on restoration resiliency will also be assessed. Two of the three sites to receive evaluation are among the most highly contaminated beaches in the United States (NRDC 2014); restoration best management practices that have been attempted or are planned at the three sites could benefit urban beaches and nearshore areas throughout the Great Lakes. These include modification of shoreline structures, dune restoration, gull deterrence, and regrading. Data used for evaluation will include continuous monitoring and synoptic mapping of nearshore currents, bathymetry, and water quality to examine nearshore transport under a variety of conditions. Biological evaluations will rely upon daily indicator bacteria monitoring, shorebird surveys, recreational usage, and other ancillary water quality data, as well as microbial community composition and their spatio-temporal differences (weekly). The pre- and post-restoration datasets comprised of these physical, chemical, and biological data will allow restoration success to be evaluated using a science-based approach with quantifiable measures of progress. Evaluation of effectiveness of restoration efforts and resiliency to climate change at urban beaches will provide vital information on the success of restoration efforts and identify potential pitfalls that will help maximize success of future nearshore restoration projects elsewhere.

**WIEGERT, ERIC J., MPH,** *Principal Sanitarian, New York State Department of Health*
Eric Wiegert of the New York State Department of Health has worked in environmental health protection for 20 years. He holds a Master's in Public Health and specializes in recreational water topics such as drowning, injury and illness prevention and water quality. He has co-authored reports published by Center for Disease Control, including a recent article on novel risk factors associated with unintentional drownings. Eric currently serves on the Great Lakes Beach Association Advisory Board.

**Reducing Drownings Using the Haddon Matrix and NYSDOH's Epidemiological Drowning Data**

*Co-author: Francesco A. Pia, PhD, New York State Department of Health*

Over the past few decades epidemiologists, state health departments, and researchers have demonstrated that aquatic injuries occur in predictable patterns with multiple recognized risk factors. Understanding the interaction between these predictable patterns and risk factors will enable participants to understand how these factors predispose children and adults to unintentional drownings and catastrophic headfirst diving spinal cord injuries. In 1972 Dr. William Haddon, Jr developed a range of injury prevention strategies known as the Haddon Matrix. His countermeasures identify, weaken or sever the links in the pre-event, event, and post event circumstances that lead to unintentional drowning and headfirst diving injuries. The Haddon Matrix will enable participants to categorize the contributing causes to from epidemiological and developmental perspectives and identify those injury prevention countermeasures that can reduce the likelihood of drowning and diving related spinal cord injuries.

Since 1983 the New York State Department of Health (NYSDOH) has collected and analyzed data regarding swimming related fatalities and serious injuries at New York State regulated aquatic facilities. This data enabled the NYSDOH to make important recommendations and regulatory code changes that have greatly reduced the incidence of serious injuries and fatalities at regulated aquatic facilities. Mr. Wiegert and Dr. Pia will discuss a strategy for developing a Haddon matrix based state health department compliant investigation tool that will guide participants in analyzing the pre-event, event, and post-event contributing factors to drownings and serious injuries within the session participants' states. The presenters believe if this approach is implemented that over time it will lead to a sharp reduction of drownings and serious injuries at the session participants regulated facilities.

**WU, CHIN,** *Professor, University of Wisconsin – Madison*

Chin Wu is a Professor in the Civil & Environmental Engineering Department at the University of Wisconsin (UW)-Madison where he is also the director of the Environmental Fluid Mechanics & Coastal Sustainability Program. His research focuses on sustainability themes, including coastal processes and sustainable coastal development, physical-chemical-biological interactions in lakes related to sustainable remediation of contaminate sediments, integrated monitoring/modeling technology development and sustainable water resources management; and sustainable lake and wetland restoration. Dr. Wu has experience in developing several nowcast and forecast systems in predicting extreme waves (http://infosapostles.cee.wisc.edu/index.html) and dangerous currents (http://infosportwashington.cee.wisc.edu/index.html).

**Integrated Nowcast-Forecast Operational System (INFOS) for Rip Current Observation, Prediction, and Warning in Lake Michigan**

*Co-authors: Yuli Liu; Prashansa Shrivastava; Gene Clark, Wisconsin Sea Grant Institute; Todd Breiby; Jesse Schomberg*

Rip currents are strong, narrow, offshore directed flows in a surf zone. They represent a major hazard contributing to hundreds of deaths annually. An outstanding 38% of water related deaths in the Great Lakes are caused by rip currents. Lake Michigan has a huge number of rip current incidents, which is responsible for 82% of the recorded incidents in the Great Lakes. 8 lives were lost due to rip currents in Lake Michigan on July 4, 2003. In this talk, an Integrated Nowcast-Forecast Operational System (INFOS) for rip current forecasting in Lake Michigan will be presented. A mechanistic process-based wave-current interaction hydrodynamic model is developed to resolve fine scale and intermittent rip currents. First, a low resolution model of Lake Michigan is taken and National Oceanic and Atmospheric Administration wind fields are used as input to drive the model. Then, the wave and current information around the areas of interest is taken from the coarse grid and applied as boundary conditions for the high resolution model to resolve the rip currents at areas of interest. This two-step process enables to capture rip currents while keeping the computational cost relatively low. Video imaging techniques

are developed to detect and characterize rip currents at areas of interest. Both modeling and observations improve our understanding of the formation and features of rip currents. INFOS will help improve the risk communication about rips and address beach hazards. Enhanced forecasts and public outreach and education will lead to safer beaches.

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National Park Service, Sleeping Bear Dunes

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University of Michigan,
Graham Sustainability Institute

Great Lakes Environmental Center (GLEC)

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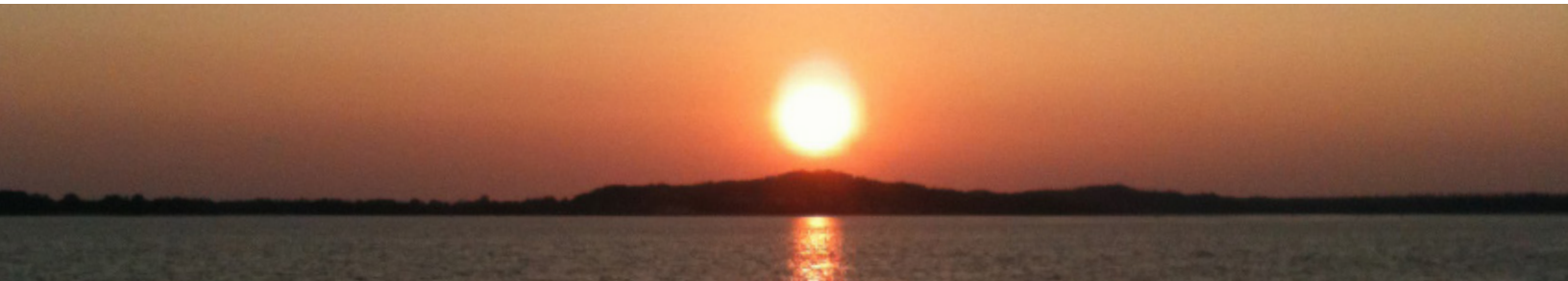

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